UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C., 20460

OFFICE OF
CHEMICAL SAFETY AND
POLLUTION PREVENTION

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Date: December 22, 2017

MEMORANDUM

SUBJECT: Registration Review: Preliminary Environmental Fate and Ecological Risk Assessment for Acetamiprid

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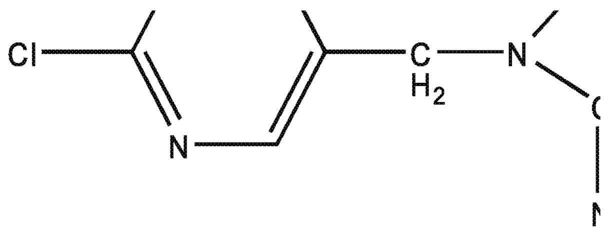
Environmental Risk Branch IV
Environmental Fate and Effects Division (7507P)

The Environmental Fate and Effects Division (EFED) has completed the preliminary environmental fate and ecological risk assessment in support of the Registration Review of the insecticide acetamiprid (N^1-[(6-chloro-3-pyridyl)methyl]-N^2-cyano-N^1-methylacetamidine; USEPA PC Code: 099050; CAS Number: 135410-20-7).

Attachment:
Preliminary Environmental Fate and Ecological Risk Assessment in Support of the Registration Review of Acetamiprid

Preliminary Environmental Fate and Ecological Risk Assessment in Support of the Registration Review of Acetamiprid



N[1]-[(6-chloro-3-pyridyl)methyl]-N[2]-cyano-N[1]-methylacetamidine
USEPA PC Code: 099050
CAS Number: 135410-20-7

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December 22, 2017

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Appendices

1. Executive Summary

Acetamiprid is a broad-spectrum cyano-substituted neonicotinoid insecticide used to control a wide variety of insect pests including sucking insects, bed bugs, termites, and ants. Acetamiprid is systemic in plants and acts as a nicotinic acetylcholine (nACh) receptor agonist by binding with the receptor. Acetamiprid is currently registered on a number of agricultural (food and non-food crops) and non-agricultural use sites. This preliminary ecological risk assessment supports the Registration Review of acetamiprid.

The risk assessment took a streamlined approach to focus on the taxa of primary risk concern based on previously completed risk assessments, and also taxa for which additional data have become available. Taxa of focus in this assessment include pollinators, birds, terrestrial-phase amphibians, reptiles, mammals, aquatic invertebrates, and terrestrial plants. However, risk conclusions for aquatic plants are summarized in this document based on previous risk assessments. The residues of concern include acetamiprid and the degradate IM 1-4 (N-methyl(6-chloro-3-pyridyl)methylamine). A total toxic residue (TTR) approach was used for the exposure assessment and estimated environmental concentrations (EECs) were compared to the toxicity endpoint of parent acetamiprid. For more information on the residues of concern see **Section 3.1** and **3.4.A**.

1.1. Risk Conclusions Summary

The following use patterns were assumed to result in minimal non-target aquatic and terrestrial exposures: spot-on application to dogs; impregnated materials and stickers; uses in tamper resistant bait stations; and spot treatments in residential areas made under slabs or inaccessible crawl spaces. Exposure from the direct applications to trees including tree injections were not quantitatively assessed, and while the potential for exposure is uncertain, this use is typically limited to high value trees and is assumed to be limited in scope (USEPA, 2017a). Exposure from applications under wood piles was not quantitatively assessed and while the potential for exposure is uncertain; it is assumed that usage is limited in scope (USEPA, 2017a).

Table 1 summarizes risk conclusions for the registered uses of acetamiprid that were quantitatively evaluated in this risk assessment. There are no aquatic risk Levels of Concern (LOC) exceedances for applications in residential areas and seed treatments. There were no LOC exceedances for freshwater and estuarine/marine fish, and for non-vascular and vascular aquatic plants[1] for any of the evaluated uses. Most foliar agricultural acetamiprid uses have the potential for direct acute and chronic effects to Federally-listed threatened/endangered ("listed" herein) and non-listed freshwater invertebrate species. RQs exceed the acute risk LOC for non-listed estuarine marine invertebrates for applications to cranberries only. Chronic RQs exceed the LOC for risk to listed and non-listed species to foliar applications to agricultural crops. Direct effects to aquatic invertebrates may indirectly affect other taxa (except aquatic plants) by changing availability of prey, habitat, and other factors important to survival and reproduction.[2] LOCs are similarly exceeded for aquatic invertebrates when considering exposure to parent alone for almost all use patterns, though RQs are reduced by roughly 33 to 68%. Additionally, monitoring data evaluating residues of parent only are available with measured acetamiprid residues in water in playas in Texas within the range of modeled estimated environmental concentrations (EECs)

[1] Risk to aquatic plant species was not explicitly addressed in this risk assessment, refer to USEPA (2015) for more details on likely risk to these taxonomic groups.
[2] Indirect effects to terrestrial and aquatic vascular plants may occur due to direct effects on birds and mammals that are important in seed dispersal or pollination of the plant.

reflecting residues of parent plus IM 1-4. Additional information on monitoring is discussed in **Section 3.2.B**.

From foliar applications to agricultural crops, there are exceedances of the acute risk LOC for both listed and non-listed birds (and by extension reptiles and terrestrial-phase amphibians). There are also exceedances of the acute risk LOC for listed small- to medium-sized mammals for some agricultural uses. For seed treatment uses, there are also exceedances of the acute risk LOC for non-listed and listed birds, and also non-listed mammals. Direct chronic risk to birds, terrestrial-phase amphibians and reptiles is also predicted for all proposed seed treatment uses; however, chronic RQs for birds may underestimate risk for passerine species as no chronic toxicity data are available for passerines. Foliar applications of acetamiprid do not represent a chronic risk to mammals; however, risk estimates exceed the chronic risk LOC for mammals from seed treatments. T-REX modeling of risks to birds and mammals was qualitatively refined by use of shorter foliar dissipation half-lives to add a lower bound to the default foliar dissipation half-life of 35 days. RQ values were reduced up to roughly 50% by foliar dissipation half-lives as short as approximately 6 days, dissipation rates shorted than 6 days did not further reduce RQs. Even with the use of the lower foliar dissipation half-life there are still LOC exceedances for non-listed and listed birds, and for listed mammals (see **Section 4.2.B** for more information).

There is the potential for direct acute and chronic effects, to adult terrestrial invertebrates (*e.g., Apis mellifera*). Available data from the chronic (repeat dose) larval toxicity test does not indicate acute or chronic effects to larval terrestrial invertebrates are expected to occur. Furthermore, semi-field studies with *A. mellifera* colonies indicate that at application rates of 0.089 lbs ai/A, there is low likelihood of adverse effects on colonies; however, the rates tested in these studies are below the maximum label rate of 0.52 lbs ai/A. There were 31 incidents associated with adverse effects to bee species that had a certainty index of probable or highly probable. There is uncertainty in whether these bee incidents are associated with acetamiprid or other pesticides applied.

There are LOC exceedances for non-listed monocots from aerial foliar applications of acetamiprid at 0.52 lbs a.i./A due to exposure from runoff, and for non-listed dicots from aerial foliar applications at or above 0.15 lbs a.i./A due to exposure from spray drift. There are LOC exceedances for sensitive listed monocots from aerial or ground foliar applications at or above 0.15 lbs a.i./A due to exposure from runoff, and for listed dicots at the same application rates due to exposure from runoff or spray drift. Additionally, an October 2017 search of the Incident Database System found 94 incidents involving acetamiprid. Fifty-five involved adverse effects to terrestrial plants. Plant incidents were all attributed to two ready-to-use (RTU) product formulations (Acetamiprid RTU Insecticide [EPA Reg. No. 8033-21] & Acetamiprid Concentrate Insecticide [EPA Reg. No. 8033-107]) containing 0.006% and 0.5% acetamiprid, respectively, and all incidents reported damage to ornamental plants or vegetables from residential uses.

1.2. Environmental Fate Summary

Acetamiprid is moderately mobile (FAO classification system) and is non-volatile from dry non-adsorbing surfaces (USEPA and PMRA, 2006). Acetamiprid may be transported to surface water and ground water via runoff, leaching, and spray drift. The primary route of degradation is aerobic soil metabolism. Degradation rates were estimated for the parent alone and for total residues of concern (*i.e.*, parent and the degradate IM 1-4). For the parent alone, aerobic soil time to 50% decline (DT_{50}) values in soil range from less than 2 days to 3 days. For parent plus IM 1-4, aerobics soil DT_{50} values range from less than 30 to 36 days. Aerobic aquatic metabolism DT_{50} values were much slower with parent DT_{50} values of 87 and 96 days and parent plus IM 1-4 DT_{50} values of 178 and 308 days. See the Environmental Fate Section for additional details on metabolism studies. Acetamiprid is stable to hydrolysis at 25°C but does hydrolyze at pH 9 and increased temperatures. Aqueous photolysis may occur in shallow, near surface environments (half-life=34 days). Terrestrial field dissipation half-lives ranged from 3 to 18 days. Acetamiprid is not likely to bioconcentrate significantly.

1.3. Ecological Effects Summary

Acetamiprid is practically nontoxic to slightly toxic to freshwater and estuarine/marine fish species on an acute exposure basis, and there is some evidence for impaired growth and reproductive effects as a result of chronic exposure. There are currently no available data to assess chronic effects for estuarine/marine fish. Acetamiprid is very highly toxic to freshwater and estuarine/marine invertebrates on an acute exposure basis, and there is evidence for reproductive effects in the former, and impaired growth effects in the latter, due to chronic exposure. There is no evidence of toxicity to aquatic vascular or non-vascular plant species from acetamiprid, with EC_{50} and NOAEC values >1 mg ai/L.

Acetamiprid is very highly toxic to passerine bird species (based on data with zebra finch [*Taeniopygia guttata*]), and moderately toxic to other birds (based on data with mallard duck [*Anas platyrhynchos*]) based on acute oral exposure. Acetamiprid is highly toxic to passerine bird species (based on data with zebra finch), and practically non-toxic to other birds (based on data with mallard duck) based on sub-acute dietary exposure. There is evidence for impaired growth and reproductive effects in mallard duck due to chronic exposure to acetamiprid; chronic toxicity data are not available for zebra finch.

Acetamiprid is highly toxic to mammals based on acute oral exposure, and there is evidence for impaired growth in mammals following chronic exposure. It is moderately toxic to terrestrial invertebrates based on acute oral and contact exposure data with adult honey bees, and there is evidence of impaired survival from chronic exposure in both adult and larval honey bees; there are no acute (single dose) data available for larval honey bees. The LD_{50} value from the available chronic toxicity test (MRID 50015703) with larval honey bees was used in place of this data for this risk assessment, and does not result in an exceedance of the acute risk LOC of 0.4, nor does the NOAEC from this study result in an exceedance of the chronic risk LOC of 1.0. While there is additional evidence of adverse effects on bees from incident reports, semi-field (tunnel) studies suggest that there are no detectable adverse colony-level effects from acetamiprid applications ≤0.089 lbs a.i./A. Based on seedling emergence and vegetative vigor studies with terrestrial plants, as well as reported incidents, there is evidence of toxicity to terrestrial plant species from acetamiprid uses.

Overall, available data suggest that acetamiprid (a cyano-substituted neonicotinoid) may be very highly toxic to some freshwater and estuarine/marine invertebrates as well as to some bird species, similar to many of the nitroguanidine-substituted neonicotinoid pesticides. Additionally, like other neonicotinoid pesticides there is considerable variability in species sensitivities amongst taxa for acetamiprid. However, for acetamiprid there is comparatively little apparent toxicity to bees (based on available data) relative to the nitroguanidine-substituted neonicotinoids, which are highly toxic to bees.

1.4. Identification of Data Needs

There are no data gaps related to the environmental fate database for acetamiprid. The following data gap currently exists for the ecological effects database for acetamiprid:

- OECD Guideline 237 Honey bee Larval Toxicity Test, Single Exposure. Currently no acute (single dose) larval toxicity data exist for honey bee or related pollinator species. The LD_{50} value from the available chronic toxicity test (MRID 50015703) with larval honey bees was used in place of these data for this risk assessment, and does not result in an exceedance of the acute risk LOC of 0.4, nor does the NOAEC from the repeat-dose study result in an exceedance of the chronic risk LOC of 1.0. Additionally, data from available semi-field studies (MRIDs 50015701 and 50091901) do not indicate that adverse colony-level effects are likely from exposure of larvae to acetamiprid at the evaluated use rates. However, there are shortcomings in the Tier II studies that result in uncertainties regarding how well they may represent likely adverse effects on larvae. According to current EFED Pollinator Guidance (USEPA *et al.*, 2014), a full suite of Tier I studies with individual honey bees are needed in part to better understand potential adverse effects on non-*Apis* bee species.

Table 1. Summary of Risk Quotients for Taxonomic Groups from Quantitatively Assessed Use Patterns of Acetamiprid[1]

Taxa	Exposure Duration and Endpoint	Risk Quotient (RQ) Range[2]	RQ Exceeding the LOC		Additional Information/ Lines of Evidence
			Non-listed	Listed (Direct effect)	
Freshwater fish	**Acute**: Mortality	<0.01	No	No	Chronic estuarine/marine data are not available for acetamiprid; however, based on the low RQs for other aquatic vertebrates, the likelihood of adverse effects is presumed to be low for products containing only acetamiprid[3].
	Chronic: growth, reduced hatchability	<0.01	No		
Estuarine/ marine fish	**Acute:** Mortality	<0.01	No	No	
	Chronic: No data	No Data[3]	No[3]		
Freshwater invertebrates	**Acute:** Mortality	0.52-1.78	**Yes**	**Yes**	Most LOCs exceeded for foliar applications to agricultural use sites when evaluating exposure for one to three seasons per year and when considering residues of TTR and parent only. Monitoring data in freshwater areas are on the high-end of model-predicted EECs and above toxicity endpoints. Chronic risk RQs for freshwater invertebrates are based on ACR[4]. No LOC exceedances for residential or seed treatment uses.
	Chronic: ACR[4]	13.13-45.50	**Yes[4]**		
Estuarine/ marine invertebrates	**Acute:** Mortality	0.16-0.57	**Yes[5]**	**Yes**	
	Chronic: body weight	4.20-14.56	**Yes**		
Mammals	**Acute:** Mortality	F[6]: <0.01-0.37 S[6]: <0.01-2.65	**Yes (S)**	**Yes**	As a result of foliar uses, LOCs were exceeded for listed species only. From seed treatment uses, there are LOC exceedances for both listed and non-listed species for canola & mustard.[7]
	Chronic: body weight gain	F: 0.02-0.78 S: 0.02-48.31	**Yes (S)**		No LOC exceedances from foliar uses; LOC exceedances from seed treatment uses for canola & mustard.[8]
Birds	**Acute:** Mortality	F: 0.02-23.51 S: 0.03-167.83	**Yes**	**Yes**	LOC exceedances across size classes for at least three food sources for all evaluated foliar uses; also LOC exceedances for almost all seed treatments.[9] LOC exceedances occur for passerine birds.
	Sub-acute (dietary)	F: 0.06-2.14	**Yes**		
	Chronic: body weight; weight gain; food consumption	F: 0.04-1.26 S: 0.79-40.49	**Yes (F, S)**		LOC exceedances occur for 4 foliar use scenarios, and canola and mustard seed treatments.[10] However, RQs may underestimate the potential for risk to passerine birds as chronic RQs are based on a NOAEC for the mallard duck, and zebra finch are as much as 15x more sensitive on an acute oral exposure basis and no passerine chronic toxicity data are available.

Taxa	Exposure Duration and Endpoint	Risk Quotient (RQ) Range[2]	RQ Exceeding the LOC		Additional Information/ Lines of Evidence
			Non-listed	Listed (Direct effect)	
Terrestrial invertebrates	**Acute Adult**	0.03-1.86	**Yes**		Tier 1 toxicity data are not available to evaluate risk to larvae, the 7-day LD_{50} from the chronic larval test was used. Semi-field studies with bee colonies do not indicate adverse effects to the colony at use rates that are lower than maximum allowed label rates.
	Chronic Adult	0.12-6.90	**Yes**		
	Acute Larval	<0.01-0.33	No		
	Chronic Larval	<0.01-0.58	No		
Aquatic plants	N/A	0.14-0.16	No	No	--
Terrestrial plants	N/A	<0.10-10.40	**Yes**	**Yes**	Non-listed species LOC is exceeded for monocots from aerial applications or ground applications ≥ 0.52 lbs a.i./A, and is exceeded for dicots from aerial applications ≥0.15 lbs a.i./A. Listed species LOC (both monocots and dicots) is exceeded for aerial applications ≥ 0.15 lbs a.i./A, and ground applications ≥ 0.249 lbs a.i./A. There are 36 plant incidents associated with acetamiprid, all involve residential incidents involving RTU formulations with ≤0.5% a.i..

RQ=risk quotient; LOC=level of concern; EEC=estimated environmental concentration; NOAEC=no observable adverse effects concentrations; RTU=ready to use; TTR=total toxic residues

[1] Level of Concern (LOC) Definitions:
Terrestrial Animals: Acute = 0.5; Acute listed terrestrial animals = 0.1; Chronic = 1.0; Terrestrial invertebrates = 0.4
Aquatic Animals: Acute = 0.5; Acute listed aquatic = 0.05; Chronic = 1.0
Plants = 1.0

[2] RQs were calculated for residues of parent plus IM 1-4 for aquatic organisms. All RQs in **Table 1** represent upper bound Kenaga values; mean Kenaga value RQs were also calculated, and can be found in **Appendix J**.

[3] An ACR could not be calculated to estimate chronic toxicity and risk to estuarine/marine fish because available acute freshwater toxicity endpoints are non-definitive (*i.e.*, ">") values. Chronic risk to estuarine/marine fish from acetamiprid exposure is presumed to be low based on available data for other fish species. Additionally, chronic risk to estuarine/marine fish from thiacloprid (another cyano-substituted [chloronicotinyl] neonicotinoid) is considered to be low, further supporting this presumption (USEPA, 2012f).

[4] RQs for chronic risk to freshwater invertebrates use an estimated chironomid chronic toxicity endpoint (chironomid acute toxicity endpoint [48-h LC_{50}: 21 µg a.i./L]) derived from an acute-to-chronic ratio of 26.4 based on available data with mysid shrimp (acute toxicity endpoint: 48-h LC_{50}: 66 µg a.i./L; chronic toxicity endpoint: 28-d NOAEC: 2.5 µg a.i./L).

[5] Acute LOCs are exceeded for estuarine/marine invertebrates for the cranberry use pattern only.

[6] RQ ranges for birds and mammals were separated to compare foliar ("F") acetamiprid applications to acetamiprid seed ("S") treatments.

[7] For mammals the number of canola or mustard seeds that would need to be consumed by small, medium and large animals, respectively, to exceed the acute risk LOC represents roughly 33, 38, and 72% of the animals' foraging diet.

[8] For mammals the number of canola or mustard seeds that would need to be consumed by small, medium and large animals, respectively, to exceed the chronic risk LOC (based on the NOAEC) represents roughly 16, 24, and >100% of the animals' foraging diet.

[9] For birds the number of canola or mustard seeds that would need to be consumed by small, medium and large animals, respectively, to exceed the acute risk LOC represents roughly <1, <1, and 4% of the animals' foraging diet.

[10] For mammals the number of canola or mustard seeds that would need to be consumed by small, medium and large animals, respectively, to exceed the chronic risk LOC (based on the NOAEC) represents roughly 8, 15, and 33% of the animals' foraging diet.

2. Problem Formulation Update

The purpose of problem formulation is to provide the foundation for the environmental fate and ecological risk assessment being conducted for the labeled uses of acetamiprid. The problem formulation sets the objectives for the risk assessment and provides a plan for analyzing the data and characterizing the risk. As part of the Registration Review process, a detailed Problem Formulation (USEPA, 2012, DP401171) for this risk assessment was published to the docket [Docket ID: EPA-HQ-OPP-2012-0329] in September 2012. The following sections summarize the key points of that document and discuss any differences between the analysis outlined there and the analysis conducted in this risk assessment.

This preliminary risk assessment examines the potential ecological risks associated with labeled uses of acetamiprid, based on the best available scientific information on the use, environmental fate and transport, and effects of acetamiprid on non-target organisms. The risk assessment methodology is described in the *Overview of the Ecological Risk Assessment Process in the Office of Pesticide Programs* ("Overview Document") (USEPA, 2004). When possible, risks identified through standard risk assessment methods are further refined using available models and data. This assessment is focused on species that are not federally listed as threatened or endangered (referred to as "listed"). Listed species are considered generically through listed species LOCs. Listed species-specific effects determinations are not included in this assessment.

2.1. Nature of Regulatory Action

The risk assessment is conducted as part of the Agency's Registration Review process for pesticide active ingredients. The Registration Review process was established under the Food Quality Protection Act (FQPA 1996)[3].

2.2. Target Pests and Mode of Action

Acetamiprid is a chloronicotinyl insecticide belonging to the cyano-substituted sub-class of the neonicotinoid pesticides. Similar to other neonicotinoids including nitroguanidine-substituted compounds such as imidacloprid, clothianidin, dinotefuran and thiamethoxam, acetamiprid is a systemic, broad-spectrum insecticide that acts against sucking and some biting insects (Sur and Stork, 2003). The compound acts as an agonist of the nicotinic acetylcholine receptor (nACh) at the postsynaptic membrane of nerve cells interrupting the function of the insect nervous system. As reported in the original Section 3 risk assessment, biochemical radio-ligand binding studies show that acetamiprid interacts with high affinity at the nACh receptor binding site in insects, and with relatively low affinity at the nACh receptor in vertebrates (USEPA, 2002, DP270368).

2.3. Currently Registered Use Patterns

2.3.A. Summary of Products and Overview of Usage (update for PRA)

Acetamiprid, an insecticide first registered in 2002 (USEPA, 2012a), is used to control a variety of insects including aphids, beetles, caterpillars, leafhoppers, stinkbugs, thrips, whiteflies, boll worms, fleahoppers, earwigs, silverfish, termites, ants, cockroaches, weevils, Colorado potato beetles, potato psyllids, wireworms, household pests, bedbugs, Lygus bug, carpenterworm, apple maggots, borers (excluding the Emerald ash borer) and scale insects. There are currently 49 Section 3 registrations containing acetamiprid and 23 Section 24C (Special Local Needs) registrations according to an EPA Office of Pesticide Programs (OPP) Information Network (OPPIN) search for actively registered products on July 5, 2017. Products containing other active ingredients in addition to acetamiprid are summarized in

[3] Available at: https://www.epa.gov/pesticide-reevaluation/registration-review-process

Appendix I[4]. Use sites include agricultural, residential, commercial, industrial, and nursery use sites, as well as some indoor use patterns. All use sites are described in more detail in the following sections.

The OPP Biological and Economic Assessment Division (BEAD) prepared a Pesticide Label Use Summary (PLUS) Report summarizing all registered uses of acetamiprid based on actively registered labels in December 2016[5]. The PLUS report was used as the source to summarize representative uses for this preliminary risk assessment. Additionally, Nisso America Inc., one of the technical registrants for acetamiprid, responded to some clarifying questions regarding labels on July 30, 2012 and responses are considered in the use summary. All references to information provided by the registrant refer to the information provided on July 30, 2012.

Formulations include water dispersible granules (WDG), emulsifiable concentrates (EC), soluble concentrates (SC), liquids, water soluble packets (WSP), impregnated stickers, impregnated bait stations, gels, and an attract-and-kill device. The WDG, EC, SC, and WSP formulations are applied as ground or aerial sprays and may result in spray drift. Gels are used as spot treatments, beads, and thin films to control ants and cockroaches. The WDG formulations are all applied as a liquid. There are also seed treatment uses on potatoes, canola, and mustard. Some liquid formulations are injected into tree trunks. Termiticides may be applied as a liquid or foam, and may be applied on soil surfaces as a perimeter treatment, crack and crevice treatment, brush, and spray. Termiticides may also be applied into soil using trenching, rodding, sub-slab injection, and soil excavation techniques, and some products are applied to sub-surfaces into piping, injections, and reticulation delivery systems. The impregnated materials are generally stickers used to control flies. The attract-and-kill device includes a pheromone that is attractive to the target organism and is mixed with acetamiprid and hung in trees.

2.3.B. Agricultural Uses and Residential Uses on Plants

Appendix I summarizes all agricultural uses with maximum single application rates provided in pounds of active ingredient per acre (lbs a.i./A). The table was developed from the PLUS report provided by BEAD in December 2016 which will be made available in the docket for acetamiprid. For complete details on registered use patterns, see the original PLUS report or registered labels. Application methods include aerial, ground boom, airblast, and chemigation broadcast of liquids to a range of agricultural crops including several crop groups covering fruit and fruit trees, tree nuts, vegetables, tuberous crops, alfalfa, canola, sweet corn, cotton, soybean, ornamentals, and tobacco. Seed treatments are also allowed on potatoes, canola/oil seed rape, and mustard.

Most of the labels that are not seed treatments are recommended to be applied to foliage or to the plant when or before the target pest is present. Some crops recommend application to coincide with a particular life cycle of a target pest (see the PLUS report for additional details). Acetamiprid is also recommended to be applied at transplant to some vegetable crops and at crop emergence for cranberries. Some labels provide limitations on the maximum amount of acetamiprid that may be applied for transplant and foliar uses.

Some labels have the following restrictions for some or all use patterns:

- A medium droplet size distribution (DSD) must be used for aerial and/or ground applications.
- Maximum wind speed of 10 miles per hour for aerial applications.
- Maximum release height of 10 feet for aerial applications.

[4] The products with multiple active ingredients are mainly applied by hand-held equipment and are not likely to result in spray drift. Two flowables, containing bifenthrin and novaluron, have the potential for drift to occur to adjacent areas and can be applied via ground boom and aerial equipment.
[5] The PLUS report is available in the Registration Review docket folder for acetamiprid.

- Amount of acetamiprid that may be applied across products is limited to 0.55 lbs acetamiprid per acre per year.
- Do not apply with irrigation equipment.
- Only apply with irrigation equipment.
- For applications to cranberries: Do not flood the treated site until 60 days the last application.

Most of these specifications are consistent with EFED standard environmental modeling assumptions.

EPA label registration number WA110010 allows for control of apple maggot in non-agricultural quarantine and pest-free areas (including residential areas) as specified under WAC 16-470[6]. The product is used on apples, crabapples, pears, ornamental plants and trees, and non-bearing fruit and nut trees. The label does not have a maximum single application rate, but does indicate that the product may be applied every 12 days, up to 4 times a year, with a maximum of 0.55 lbs a.i./A per year. While the PLUS report indicates that this label expired, an updated OPPIN query indicates that it is still currently registered.

Registrants provided some clarification on minimum planting depths in the focus meeting materials (½-inch deep for canola and mustard and 5 inches for potatoes). Canola and mustards are commercial seed treatments and potatoes pieces may be treated commercially or on the farm. These planting depths are not specified on the label.

2.3.C. Use on Trees

Four different labels allow for use as tree trunk injections or basal bark treatments (EPA Reg. Nos. 8033-94, 8033-96, 8033-106, 8033-109) on ornamental and non-bearing fruit and nut trees. Tree injection uses allow for 0.0024 – 0.004 lbs a.i. per inch diameter at breast height (DBH). Basal bark treatments involve wetting the bark of the tree starting from a height of approximately eight feet downwards to the exposed root flair with a directed spray to completely wet the application area. Applications are made with a backpack sprayer. Only single application rates are provided on the labels with use rates described in **Table 2**. One label has some recommendations for tree injection to control termites. The registrant clarified that the tree use patterns would be used in nurseries as a spray (see the agricultural use pattern section for details) or residential areas for treatment of economically important plants. Based on information provided by the registrant, typical spray volumes recommended per acre ranged from 100 to 300 gallons of spray per acre with treatment of up to 200 trees (but could be up to 100,000 trees per acre for conifers). The registrant indicated that the ornamental label recommendations (see the use patterns described in **Appendix J** for ornamentals) would apply to the tree use applications. However, these restrictions are not specified on labels.

Table 2. Summary of Use Patterns for Ornamental or Non-Bearing Fruit and Nut Trees

Use Site	Application Method	Timing	Formulation	Single Application Rate Recommendations
Hybrid Poplar	Device applied to tree with string	Spring and Summer	Attract-and-kill Device	0.00000265 lbs ai/A
Ornamental and Non-bearing Fruit and Nut Trees	Tree injection treatment	Bud break through foliar	L, SC-solid	0.0024 - 0.0025 lbs ai/DBH
	Basal bark treatment	Bud break through foliar (Mid Spring)	L	NS, 0.004 lbs ai/DBH 0.15 lbs ai/ gal/36-42 DBH

L=liquid; SC-solid=soluble concentrate, solid; DBH=diameter breast height in inches; gal=gallon

[6] Washington Administrative Code (WAC). Title 16. Chapter 16 – Agricultural Pests. Available at: http://apps.leg.wa.gov/wac/default.aspx?cite=16-470 (accessed November 3, 2017).

2.3.D. Residential and Structural Uses

A number of products are registered for control of termites, ants, and various other insects around homes, buildings, eating establishments, animal production sites, equipment, ships and boats, transportation facilities, paths, patios, and wood protection treatment, *etc.* (**Table 3**). These uses include surface application to soils, mound treatments, drench treatments, perimeter treatments, soil injection, trenching, rodding, void treatments, spot treatments, soil excavation treatments, crack and crevice treatments, drench, bait applications, mound treatments, and insecticidal strip treatments. Some termiticide products are applied to sub-surfaces into piping and reticulation delivery systems. Soil excavation involves digging up soil, treating it, and then replacing the soil. Rodding involves drilling a series of holes (no more than 12 inches apart) into the ground, injecting the pesticide, and then covering the hole. Trenching (may be 6 inches deep and wide) involves digging a trench around a structure and treating the trench. Often trenching and rodding are both used in treatments. Perimeter treatments may be up to 10 ft wide around the structure and up to 3 ft high on the structure. No information was available on application intervals or maximum number of applications per year. The PLUS report indicates that 19 and 23 lb ai/A may be applied as a spot treatment; however, this "spot treatment" rate" would not be applied over an entire acre, and the application rate on the labels are provided along with directions on the ounces of product that may be applied per 8 or 10 square foot basis. The labels specify that the equivalent of 19 and 23 lbs a.i./A applications may be made under wood piles, as a horizontal barrier treatment preconstruction under slabs, in inaccessible crawl spaces, and under slabs. Given that these locations are relatively inaccessible to most non-target taxa, potential exposure is considered likely to be limited from the 19 and 23 lbs a.i./A applications.

In addition to the structural use patterns, acetamiprid may be used on ornamentals, residential trees, and residential garden vegetables. The application rates for these use patterns are similar to or lower than the agricultural application rates or have a rate that is not readily extrapolated to a per acre basis. Some labels are not clear on the maximum number of applications per year or minimum retreatment interval for these use patterns. The PLUS report also listed a number of applications allowed in residential areas using a hand-held sprayer to ornamentals, trees, vegetables, and berries where the amount of acetamiprid that may be applied per area is not specified (EPA Reg. No. 8033-107).

Table 3. Summary of Uses Around Buildings, Paths, Wood, and Equipment

Use Site	App. Target	App. Type	App. Equipment	App. Timing (Site Status)	A.I. Max Rate / App.	Unit
Buildings/ Utilities/ Electrical Equipment	Surface	Crack and Crevice/ Slab/ Rodding/ Trenching/ Spot/ Sub-slab	Hand injection equipment	Pre- or post-construction	0.000859	lb/linear ft*
Buildings	Soil (subsurface) Soil (surface)	Sub-slab Rodding/ Trenching	Hand injection/spra yer equipment	Post-construction	0.00172	lb/linear ft*
Buildings	Surface/ Soil (surface) Surface	Crack and Crevice or Spot treatment	Hand injection equipment	Post-construction	0.00434	lb/1 gal*
Buildings	Soil (surface)	Spot treatment	Hand sprayer	Pre- or post-construction	19	lb/a*

Use Site	App. Target	App. Type	App. Equipment	App. Timing (Site Status)	A.I. Max Rate / App.	Unit
Building/Structural Component	Soil (surface)	under slabs, wood piles, or inaccessible areas	Handheld or backpack sprayer	Pre- or Post-pest occurrence	23	lb/a*
Impervious Paved Areas Buildings/ Structural component	Soil (surface)	Spot Treatment/ Mound Drench/ Perimeter	Handheld or backpack sprayer/ Foam Applicator or Hand Injection Equipment	Pre- or Post-pest occurrence	0.189	lb/a*
Residential Outdoor (gardens, trees, etc.)	Foliar	Spot	Hand-held equipment	As needed	0.0375	lb/a**

* These application rates are not expected to be applied over an entire acre, but only to a limited portion of an acre. The registrant indicated that these use patterns would not be applied at greater than 0.2 lbs a.i./A; however, this use rate is not specified on the label.
** The registrant summarized that the product could be applied at a rate of 0.0375 lb ai/A, 5 times, over 3 crop cycles. The maximum annual application rate was 0.56 lb a.i./A. This material was provided by the registrant on July 30, 2012 and is not reflected on the label.

2.3.E. Other Use Patterns

The following use patterns are also allowed for acetamiprid. These use patterns are assumed to result in minimal exposure to aquatic and terrestrial non-target organisms.

- Acetamiprid may be applied to dogs as a spot-on treatment. Environmental exposure from this use pattern is expected to be *de minimis*.
- One of the labels (EPA Reg No. OR09005) is an attract-and-kill device to control carpenter worm in poplar trees. The device is attached to trees with a string. Acetamiprid is mixed with a grease and pheromone in the device.
- EPA Reg No. 8033-117 is a house fly bait used in tamper-resistant bait stations around the outside of confined animal feeding operations such as stables, dairies, poultry houses, feed lots, swine buildings, animal pens, and kennels in and as a scatter bait at a rate of 0.0817 lbs ai./A. It may be used indoors (including on walkways inside caged layer houses) or in enclosed outdoor areas that prevent access to the bait by birds.

2.3.F. Usage Information

Based on market usage data from 2000-2010, agricultural usage averaged approximately 60,000 lbs ai and 900,000 acres treated (USEPA, 2012a). The screening-level use assessment (SLUA) estimate, which only considers agricultural use, indicates that 33% of the acetamiprid used in agricultural areas is applied to apples and cotton (20,000 lbs ai/year on average). On average, 2000 to 5000 lbs of acetamiprid per year is applied to each of the following crops: pears, oranges, lettuce, strawberries, and grapes. On average, acetamiprid was applied to greater than 15% of pears, celery, strawberries, apples, grapes, and lettuce. See the SLUA in the Registration Review docket for additional information on use and usage described here.

Based on proprietary non-agricultural market research data from 2012, it was estimated a total of 2,200 lbs of acetamiprid was sold to pest control operators who treat private residences (USEPA, 2017a) across the United States. This does not consider the amount of acetamiprid sold to residential consumers. Additional information on usage in residential areas will also be made available in the docket (USEPA, 2017a).

2.4. Most Recently Completed Ecological Risk Assessment

The new chemical assessment for acetamiprid was first completed in 2002 and the most recent risk assessment was completed in 2015 (USEPA, 2015, DP426111+). In 2011, an assessment was completed for both existing and newly proposed agricultural uses because of changes in the assumed residues of concern. For aquatic organisms, the degradate IM 1-4 and unextracted residues were assumed to also be residues of concern (ROC) or an uncertainty and a total toxic residues (TTR) approach was used to assess risk. The degradate IM 1-4 was considered as a ROC in the 2011 assessment because it has a considerably longer half-life in both soil and water than the parent compound and empirical data suggest it has similar toxicity as the parent compound (*i.e.*, both are classified as slightly toxic) to some aquatic invertebrates. Parent alone was also evaluated. The risk assessment concluded that all proposed uses of acetamiprid have the potential for direct acute effects to listed aquatic invertebrates. There was also the potential for direct acute effects to non-listed aquatic invertebrates for five of the seven crop uses (including fruiting vegetables, citrus, and pome fruit) evaluated at that time. The Agency's chronic risk LOC for aquatic invertebrates was also exceeded for all proposed crop uses of acetamiprid. The assessment completed in 2015 had a similar risk conclusion for aquatic organisms when considering risks evaluated for TTR and for parent alone.

The 2011 and 2015 assessments also indicated that for terrestrial organisms, there was a potential for direct acute effects to both listed and non-listed birds (along with reptiles and terrestrial-phase amphibians for which birds serve as surrogates) for all of the proposed crop uses of acetamiprid. The relatively higher risk estimates for birds compared to previous assessments were based on a study (MRID 4840770) submitted in 2011 in which acetamiprid was shown to be very highly toxic to the passerine zebra finch (*Taeniopygia guttata*) on an acute oral exposure basis. The assessment also indicated that acetamiprid had the potential to cause direct acute adverse effects to listed mammals and direct adverse effects to terrestrial plants for all uses evaluated except for soybeans. In addition, there was also potential for adverse effects to non-listed terrestrial plants for assessed uses on citrus and pome fruit and acute and chronic risk to mammals when used as a scatter bait. The proposed outdoor scatter bait use pattern was revised on the final label to limit the potential exposure to birds.

Although the 2011 and 2015 assessments did not predict direct risk to fish (for products containing acetamiprid alone) or aquatic plants for any assessed uses, the assessment noted that potential indirect effects to all taxa except aquatic plants could occur due to effects on prey and/or habitat.[7]

The major environmental fate and ecological risk conclusions identified in previous assessments are summarized in **Table 4** and **Table 5**. Not all of the previously evaluated uses were subsequently registered; however, the overall risk conclusions still apply to currently registered use patterns.

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[7] Indirect effects to terrestrial and aquatic vascular plants may occur due to effects on birds and mammals that are pollinators or important in seed dispersal of the species.

Table 4. Potential for Direct Effects Identified in Previous Acetamiprid Assessments[1]

<table>
<tr><th>Listed/or non-listed</th><th>Birds[2]</th><th>Mammals</th><th>Terrestrial Invertebrates</th><th>Aquatic Vertebrates[3]</th><th>Aquatic Invertebrates</th><th>Terrestrial Plants</th><th>Aquatic Plants</th></tr>
<tr><td>Non-listed</td><td rowspan="2">Acute and Chronic*</td><td rowspan="2">Acute and Chronic[4]</td><td rowspan="2">Yes*</td><td>--</td><td rowspan="2">Acute and Chronic</td><td>Dicots*</td><td>--</td></tr>
<tr><td>Listed</td><td>--</td><td>Dicots and Monocots*</td><td>--</td></tr>
</table>

-- = Risk below level of concern (LOC); * indicates a full data set was not available
[1] Risk concerns were identified when the risk quotient (RQ) exceeded the corresponding LOC in a previous risk assessment or were identified as a potential concern based on weight-of-evidence.
[2] Birds serve as surrogates for terrestrial-phase amphibians and reptiles.
[3] Fish serve as surrogates for aquatic-phase amphibians.
[4] Chronic risk LOCs were exceeded for mammals for the proposed scatter bait use only. Acute risk LOCs for mammals were exceeded for the proposed scatter bait use as well as some other use patterns. The outdoor scatter bait use was not registered as proposed.

Table 5. Potential Environmental Fate Concerns Identified in Previous Acetamiprid Assessments

Bioconcentration/ Bioaccumulation[1]	Ground water Contamination[2]	Sediment	Persistence	Residues of Concern	Volatilization	Major Route of degradation
No, log K_{ow}<3	Yes[2]	Yes	Uncertain[3]	Acetamiprid, IM 1-4, Unextracted Residues	No	Aerobic Metabolism

IM1-4 =N-methyl(6-chloro-3-pyridyl)methylamine
[1] Based on whether previous assessments indicated this was a risk concern or if previous assessments ran K_{ow} Based Aquatic Bioaccumulation Model (KABAM) for chemicals with a log K_{ow} >3.
[2] Previous risk assessments indicated that acetamiprid has the potential to reach groundwater; however, it did not result in drinking water concentrations high enough to cause a concern for human health. Plant risk LOCs were exceeded for plants exposed to residues in irrigation water.
[3] For acetamiprid, time to 50 percent degradation (DT_{50}) values were on the order of days in aerobic soil studies (<1 day to six days) and weeks to months in aerobic aquatic metabolism studies (23 to 96.2 days). Overall, DT_{50} values for total ROC are persistent (greater than 180-days) (Goring *et al.*, 1975). These previously reported half-lives have been updated in this risk assessment.

2.5. Identification of Residues of Concern

Here we discuss the identified residues of concern, as recommended and discussed in the problem formulation (USEPA, 2012, DP401171). All major degradates of acetamiprid identified in fate studies have a similar pyridylmethylamine backbone as the parent, and cannot be eliminated from scrutiny based on structural properties alone. Additionally, IM 1-2, IM-1-3, IM 1-4, IM 1-5, and IC-0 are all considered major degradates as they were observed with greater than 10% applied radioactivity associated with the degradate in some studies. Degradates IM-1-3, IM 1-4, and IM 1-5 were also relatively stable with peaks observed at the final sampling interval or high levels observed in studies over many days. While IM 1-3 is relatively stable, it was only a major degradate in the hydrolysis study (pH 9 at 35°C and 45°C and biotic metabolism is expected to be its predominant degradation pathway. Fate data suggest that exposure to these degradates (especially IM 1-4) could be significant compared to exposure to the parent.

Empirical toxicity data were used to determine whether degradates should be considered a residue of concern. Based on empirical toxicity data (**Table 6**), degradates IM 1-2, IM 1-5, IC-0, and IM-0 only have one or two established endpoints that can be compared with parent data from the same species. Based on these limited data, these four degradates appear to be less toxic than the parent. It should be noted that of the four degradates listed above, only IM 1-5 has data for any taxon that is considered to be highly sensitive to the parent (*i.e.*, midges and mysid shrimp). In this case, IM 1-5 is several orders of magnitude less sensitive to the non-biting midge than the parent compound. There is somewhat more data for IM 1-4 compared to the other degradates, and based on available data, IM 1-4 appears to be similarly toxic to daphnids as the parent, but is considerably less toxic to mysid shrimp. In fish, it is not possible to make an adequate comparison because both acetamiprid and IM 1-4 endpoints are non-definitive. The assumption will be made in this risk assessment that IM 1-4 is a residue of concern for all aquatic animals

Table 6. Comparison of Available Empirical Toxicity Data for Acetamiprid and Degradates

Compound	Empirical (Measured) Toxicity Endpoints						
	Rainbow Trout 96-hr LC_{50}	Daphnid 48-hr LC_{50}	Mysid Shrimp 96-hr EC_{50}	Non-biting Midge 96-hr LC_{50}	Daphnid Chronic NOAEC	Mallard Subacute Dietary LC_{50}	Rat Acute Oral LD_{50}
Units*	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/kg-diet**	**mg/kg-bw**
Acetamiprid	>100	50	0.066	0.021	5.0	>5000	146
IM-1-2	--	>99.8	--	--	--	--	2176
IM-1-4	>98.1	43.9	19	--	--	>5000	1088
IM-1-5	--	--	--	68	25	--	--
IC-0	--	>95.1	--	--	--	--	>5000
IM-0	--	--	--	--	--	--	1792

* All units are expressed in terms of the parent or degradate (*e.g.*, mg acetamiprid/L water or mg degradate/L water)

In an effort to supplement available empirical toxicity data for acetamiprid transformation products, estimated toxicity data were generated using quantitative structure-activity relationships (QSAR) derived in the program ECOSAR[8] (version 1.00). ECOSAR is only used to prioritize the need for additional data on degradates, not to derive endpoint values for use in estimating risk. ECOSAR estimates were compared to measured toxicity information for parent and degradates (**Table 7**). QSAR estimates specific to the parent compound class (*i.e.*, halopyridines) were not accurate when compared to measured data. Moreover, ECOSAR estimates for degradates were also not accurate compared to the empirical degradate dataset. Therefore, ECOSAR estimates appear to be of limited use in predicting degradate toxicity for these degradates. ECOSAR did, however, predict increased chronic toxicity of IM-1-4 in daphnids (0.025 mg IM 1-4/L) compared to that of the parent (0.097 mg acetamiprid /L) (**Table 7**) when using the aliphatic amine chemical class as the basis for analysis.

Table 7. ECOSAR Quantitative Structure-Activity Relationship (QSAR) Toxicity Predictions for Acetamiprid and Degradates

Compound (compounds class used by ECOSAR)	Estimated Toxicity Endpoint (mg/L)				
	96-hr FW Fish LC_{50}	48-hr Daphnid LC_{50}	96-hr EC_{50} Green Algae	Fish Chronic Value	Daphnid Chronic Value
ECOSAR TOXICITY PREDICTIONS					
Acetamiprid (Parent)					
Empirical (*Measured*)	>100	50	>1.3	19.2	5.0
Halopyridines	0.21	0.73	--	0.30	0.97
Neutral SAR	59	36	19	5.5	3.7
IM 1-2					
Empirical (*Measured*)	--	>99.8	--	--	--
Amides	771	236	1.6	4.6	--
Halopyridines	0.225	1.4	--	8.9	--
Neutral SAR	5774	2692	563	570	182
IM 1-3					

[8] http://www.epa.gov/oppt/newchems/tools/21ecosar.htm

Compound (compounds class used by ECOSAR)	Estimated Toxicity Endpoint (mg/L)				
	96-hr FW Fish LC_{50}	48-hr Daphnid LC_{50}	96-hr EC_{50} Green Algae	Fish Chronic Value	Daphnid Chronic Value
Amides	284	101	1.0	1.7	--
Halopyridines	0.19	1.0	--	3.9	--
Neutral SAR	2008	988	248	196	72
IM 1-4					
Empirical (*Measured*)	>98.1	43.9	--	--	--
Aliphatic Amines	182	14	3.8	2.8	0.025
Halopyridines	0.15	0.80	--	3.3	--
Neutral SAR	1724	843	208	169	61
IM 1-5					
Empirical (*Measured*)	--	--	--	--	25
Halopyridines	0.184	1.369	--	27.067	0.752
Neutral Organic	28011	11695	1682	2821	673
IC-0					
Empirical (*Measured*)	--	>95.1	--	--	--
Halopyridines-acid	1.5	6.9	--	12	1.1
Neutral SAR	447	238	78	43	20
IM-0					
Halopyridines	0.13	0.75	--	--	--
Benzyl Alcohols	360	194	--	--	--
Neutral SAR	1934	934	221	190	67

Based on the available information, none of the identified degradates appear to be more toxic than the parent. There is some evidence that acetamiprid and IM 1-4 may be similarly toxic to daphnids; conversely, mysid shrimp are approximately two orders of magnitude more sensitive to parent acetamiprid than to IM-1-4. Based on toxicity results for these two species, the extent of IM 1-4 toxicity to aquatic animals besides mysid shrimp is uncertain.

Method of Estimating Exposure and Evaluating Risk for Degradates

To estimate exposure to compounds assumed to have a similar toxicity to the parent (*e.g.,* IM 1-4 for aquatic organisms), a TTR approach is used by summing the residues observed in fate studies and then estimating degradation rates based on the total summed residues. The TTR degradation rates are used to estimate exposure in place of degradation rates for the parent alone. As stated previously, the residues used to estimate degradation rates to estimate exposure for aquatic organisms are parent and IM-1-4. The modeled TTR amounts are then compared to toxicity endpoints for the parent or IM-1-4, whichever is more sensitive for each taxon.

2.6. Analysis Plan

Stressors of concern include parent acetamiprid and the IM 1-4 degradate of acetamiprid. The environmental fate properties of acetamiprid indicate that for foliar applications, spray drift and runoff are potential transport mechanisms to aquatic habitats where non-target organisms may be exposed. It is expected that non-target terrestrial organisms can be exposed via foliar applications of acetamiprid through consumption of exposed plants and invertebrates on treated fields. Terrestrial organisms may also be exposed through ingestion of treated seed. Additionally, acetamiprid may reach terrestrial environments off the field via spray drift. Acetamiprid is systemic and may be transported into terrestrial plants with a soil or foliar application. A summary of the transport pathways and the models used to represent those pathways in the assessment are provided **Table 8** in the Measures of Exposure **Section 3.1.B**.

2.6.A. New Studies and Procedures

The preliminary problem formulation provides an analysis plan for acetamiprid (USEPA, 2012, DP401171). Since the problem formulation was completed, an aerobic aquatic metabolism study (MRID 49734003), aerobic soil metabolism (MRID 49734002), and anaerobic aquatic metabolism study (MRID 49734004) were submitted. More specific information on these new data are available in the exposure modeling section. The additional data result in updated aquatic modeling input values.

New EFED guidance completed since the 2011 Problem Formulation that will impact this exposure assessment in terms of calculating updated EECs includes new guidance on degradation kinetics (USEPA, 2012d), modeling spray drift (USEPA, 2013b), and evaluating unextracted residues (USEPA, 2014b).

Below is a listing of the effects studies submitted and/or reviewed since the 2011 preliminary problem formulation was completed, with a summary of how the new data could impact the risk conclusions.

- Acute toxicity to the freshwater invertebrate *Daphnia magna* with 70% Wettable Powder Formulation (MRID 49056401)
- Subacute dietary toxicity study with the zebra finch (*Taeniopygia guttata*) (MRID 48844901)
- Reproductive toxicity to mallard duck (*Anas platyrhynchos*; MRID 49342202)
- Seedling emergence to terrestrial plants (MRID 49356501)
- Acute contact and oral toxicity of EXP 60707 A (TEP, 20% acetamiprid) to adult honey bees (*Apis mellifera* spp. *mellifera*) (MRID 50015704)
- Chronic oral toxicity of acetamiprid TG (99.63% a.i.) to larval honey bees (*Apis mellifera* spp. *mellifera*) (MRID 50015703)
- Chronic oral toxicity of acetamiprid TG (99.63% a.i.) to adult honey bees (*Apis mellifera* spp. *mellifera*) (MRID 50015702)
- Semi-field study examining the effects to honey bees from two applications of Acetamiprid 20 SG to *Phacelia tanacetifolia* (MRID 49342201)
- Honey bee colony semi-field residue test with Acetamiprid 20 SG (19.9% a.i.) (MRID 50015701)
- Honey bee colony full-field residue test with Acetamiprid 20 SG (19.9% a.i.) (MRID 50091901)

These new data are described in more detail in the effects characterization (**Section 3.4)** and also in **Appendix B**. The subacute dietary toxicity data for the zebra finch and mallard duck are more sensitive than previously submitted data, and therefore have the potential to influence the risk conclusion and calculated RQs. While the acute or chronic (larval and adult) honey bee studies are not entirely consistent with current guidelines/guidance, they provide some useful information for characterizing potential risk to bees. The uncertainties associated with new bee studies are discussed further in **Appendix B.**

The main new guidance related to the overall risk assessment process includes *Guidance for Assessing Pesticide Risks to Bees (USEPA et al., 2014)* and *Toxicity Testing and Ecological Risk Assessment Guidance for Benthic Invertebrates (USEPA, 2014c).*

The other updates from the preliminary Problem Formulation include that EFED is not assessing the risk from the use of irrigation water as a potential pathway of concern for terrestrial plants.

Additionally, there was a process for estimating aquatic and terrestrial exposure from the use of acetamiprid on individual trees discussed in the preliminary Problem Formulation. BEAD concluded "that given the likely high cost of tree injection methods, the sporadic nature of pest infestations serious enough to require such treatments, and the low usage of acetamiprid in residential settings, tree injection use of acetamiprid is probably a minor component of residential use " (USEPA, 2017b). Englert *et al.* (Englert, Bakanov, *et al.*, 2017) measured residues of acetamiprid in foliage[9] of treated trees at the time of leaf fall and the concentrations were used as model inputs to estimate potential aquatic concentrations in an adjacent stream. The predicted stream concentrations were well below (maximum of 250 ng/L) toxicity thresholds for acetamiprid for aquatic organisms[10]. While data indicate that residues in trees will occur from application of acetamiprid to trees, a methodology to estimate exposure in pollen and nectar is not available. As BEAD indicated, this use pattern has low usage and, due to lack of confidence in reliable exposure estimates, additional analysis on the potential risk from tree injection and bark treatments are not explored further in this assessment. There is some literature on potential risk to leaf shredders that break down leaves that have fallen from trees from the use of acetamiprid (Englert, Zubrod, *et al.*, 2017). The potential risk to leaf shredders is covered in the risk assessment completed by EFED using standard procedures. Risk to aquatic organisms from tree injections is expected to be lower than the evaluated agricultural uses.

Finally, this risk assessment focuses on taxa of primary risk concern based on previous risk assessment conclusions, and on taxa for which new data were available that could impact previous risk conclusions. Therefore, this risk assessment will not re-assess risk to aquatic plants, as there are no new data that will impact conclusions from the previous assessment (USEPA, 2015). However, in recent risk assessments (USEPA, 2012, DP401171, 2015, DP426111+), risk to birds and mammals from seed treatment uses were not assessed. So, while there are no new data that could impact conclusions from previous risk assessments regarding risk to mammals, this assessment evaluates risk to this taxonomic group. Hence, this risk assessment focuses on aquatic invertebrates, birds (a surrogate for reptiles/amphibians), mammals, insect pollinators, and terrestrial plants.

As acetamiprid has a large number of use patterns, use patterns were chosen to be quantitatively evaluated to provide a bounding on risk estimates (*e.g.*, RQs), as well as, RQs for use patterns with high usage and/or a unique modeling scenario. Based on the use (PLUS report) and usage (SLUA) and information provided by BEAD, the following use patterns are quantitatively evaluated in this risk assessment: cotton, pome fruit, citrus, tree nuts, leafy vegetables, 13-07-G Low Growing Berry Subgroup (including cranberries), ornamentals, cranberries, seed treatments, and residential use patterns. These use patterns are summarized in **Table 15**.

2.6.B. Measures of Exposure

This assessment uses standard EFED models to evaluate exposure to acetamiprid in aquatic and terrestrial environments. These models are summarized in **Table 8**. Additional information on models used to generate aquatic EECs and terrestrial can both be found at https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/about-water-exposure-models-used-pesticide.

Aquatic EECs for acetamiprid are determined for TTR, which includes parent acetamiprid and the degradate IM 1-4. Aquatic EECs were also calculated for parent alone for the purposes of risk characterization. The degradate IM 1-4 was chosen as a residue of concern for the purposes of aquatic

[9] Black alder trees treated with neonicotinoids at standard and above standard rates had measured concentrations of neonicotinoids ranging from 4.4 ng/g to 30 μg/g dry weight leaves (Englert, Bakanov, *et al.*, 2017). This study has not been fully reviewed and the reliability of these data are uncertain.
[10] The aquatic modeling in this document was not fully reviewed and the reliability of these data are uncertain.

exposure due to its similar (relative to parent acetamiprid) acute toxicity to freshwater aquatic organisms, and in particular Rainbow trout (*Oncorhynchus mykiss*) and the water flea *(Daphnia magna)*. There are also available data that suggests similar toxicity for mallard duck (*Anas platyrhynchos*), but there are no available data on IM 1-4 toxicity for the more sensitive passerine birds such as zebra finch. As there are limited data on the toxicity of IM 1-4 to standard test species, there is some uncertainty regarding risk to organisms in the environment from exposure to IM 1-4. To account for parent plus IM 1-4, the default 35-day foliar dissipation half-life is used in T-REX modeling. Additionally, for characterization purposes a foliar dissipation half-life of 6.15 days was used to estimate risk from parent acetamiprid alone.

Table 8. List of Various Models and Related Taxa for Which Models Will be Used to Assess Risk

Environment	Taxa of Concern	Exposure Media	Exposure Pathway	Model(s) or Pathway
Aquatic	Vertebrates/ Invertebrates (including sediment dwelling)	Surface water and sediment	Runoff and spray drift to water and sediment	PWC (v 1.52, February, 2016) PFAM (v.2.0, September 27, 2016)
	Aquatic Plants (vascular and nonvascular)			
	Riparian plants	See terrestrial exposure pathways		
Terrestrial	Vertebrate	Dietary items	Ingestion of residues in/on dietary items as a result of direct application	T-REX (v. 1.5.1; June 6, 2013b)
		Consumption of aquatic organisms	*Residues taken up by aquatic organisms*	*KABAM* (version 1; April 2009)
	Plants	Spray drift/ runoff	Runoff and spray drift to plants	TERRPLANT (version 1.2.2; December 26, 2006)
	Bees and other terrestrial invertebrates[1]	Contact Dietary items	Spray contact and ingestion of residues in/on dietary items as a result of direct application	Bee-REX (2015)
All Environments	All	Movement through air to aquatic and terrestrial media	Spray drift	AgDRIFT (version 2.1.1; December 2011)
				AgDISP
			Atmospheric transport	*Not a major transport pathway*

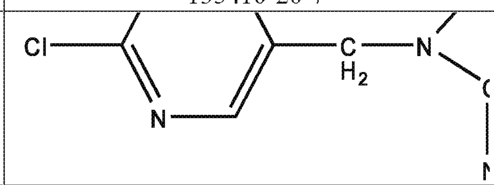
Text in *italics* represent transport pathways that are not of concern.

3. Analysis

3.1. Environmental Fate Summary

Acetamiprid is classified as moderately mobile using the Food and Agriculture Organization (FAO) classification system (K_{OC} = 157- 298 L/kg-organic carbon) and may be transported to surface water and/or groundwater via runoff, leaching, and spray drift. Aerobic soil metabolism is the primary route of degradation of acetamiprid with DT_{50} values on the order of days in aerobic soil studies (DT_{50}s range from 1.85 day to 3.20 days) and months in aerobic aquatic metabolism studies (DT_{50}s range from 87 to 96 days). Acetamiprid is stable to hydrolysis at 25°C at pH 5, 7, and 9 at 25°C but does undergo some hydrolysis at pH 9 and at higher temperatures (≥35°C). Acetamiprid may undergo aqueous photolysis (half-life = 34 days) in clear and shallow surface water. Anaerobic aquatic metabolism was much slower than aerobic aquatic metabolism, with DT_{50}s ranging from 477 to 585 days in two sediments (MRID 49734004). Based on its low log octanol-water partition coefficient (log K_{ow} = 0.08 at 25°C), acetamiprid is not expected to bioconcentrate significantly; BCF data were not submitted. The terrestrial field dissipation half-lives for acetamiprid applied to domestic food, fiber and ornamental crops ranged from three to 14 days for residues in 0 to 15 cm (MRIDs 44988514, 44988515). The terrestrial field dissipation half-lives for acetamiprid applied to bare ground plots (determined in Canadian soils) ranged from five to 18 days (MRID 44988625). While terrestrial field dissipation half-lives reflect a number of loss processes and are not expected to be the same as the laboratory fate results that are intended to reflect one loss process, some useful information can be gained in comparing the dissipation values with the laboratory degradation study results. Leaching to the lowest depth sampled was observed in some but not all of the terrestrial field dissipation studies. Terrestrial field dissipation half-lives are longer than some of the aerobic soil metabolism half-lives and shorter than others (**Table 11**). **Table 9** summarizes the identity information, physical-chemical properties, and sorption coefficients of acetamiprid and **Table 10** summarizes laboratory degradation studies. A detailed description of the environmental fate data is available in **Appendix A**.

Table 9. Summary of Physical-chemical Properties and Sorption Coefficients of Acetamiprid

Parameter	Value	Source	Comments
PC Code	099050	None	None
CAS Number	135410-20-7	(USNLM, 2009)	None
Structure		--	None
Chemical Name	N^1-[(6-chloro-3-pyridyl)methyl]-N^2-cyano-N^1-methylacetamidine	MRID 44651803	None
Molecular Weight	222.68	MRID 44651803	None
Water Solubility	4250 mg/L (25°C)	MRID 44651811	None
Vapor Pressure	<1 x 10^{-8} Torr at 25°C	MRID: 46235701	Nonvolatile from dry non-adsorbing surfaces (USEPA, 2010a)
	7.50 x 10^{-10} Torr at 25°C 1 X 10^{-4} mPa at 25°C	Footprint Database[2]	
Henry's Law constant	5.2 x 10^{-14} atm-m^3/mol at 25°C (estimated)	(Estimated from vapor pressure and water solubility at pH 7 and 25°C)	Calculated with vapor pressure reported by AERU (2009).
Dissociation Constant	0.7 at 25°C	(USEPA, 2002)	Protonation of the H on the pyridine ring. No ionization expected at environmental pH.
Log K_{OW}	0.8 at 25°C	MRID 44651883	Not likely to bioconcentrate (USEPA, 2010a)
Soil-Water Distribution Coefficients (Kd)	**Soil/Sediment** / **Kd (L/kg)** / **K_{OC} (L/kg-oc)** loamy sand, pH 4.4 / 0.39 / 157	MRID 44651883	Moderately Mobile (FAO classification system)

ED_006569G_00033688-00022

Parameter	Value			Source	Comments
Organic carbon normalized distribution coefficients (Koc)	loamy sand II, pH 6.2	3.9	266		
	silt loam, pH 6.6	1.1	251		
	clay, pH 7.5	3.5	298		
	sandy loam sediment, pH 5.6	4.1	164		

[1] All estimated values were estimated according to "*Guidance for Reporting on the Environmental Fate and Transport of the Stressors of Concern in Problem Formulations for Registration Review, Registration Review Risk Assessments, Listed Species Litigation Assessments, New Chemical Risk Assessments, and Other Relevant Risk Assessments*" (USEPA, 2010a).
[2] AERU. 2009. The FOOTPRINT Pesticide Properties Database. Agriculture & Environment Research Unit (AERU). Available at http://sitem.herts.ac.uk/aeru/footprint/ (Accessed November 3, 2017) (AERU, 2009).

Transformation products resulting from the environmental degradation of acetamiprid are:

- N-methyl(6-chloro-3-pyridyl)methylamine (IM 1-4)
- (E)-N1-[(6-chloro-3-pyridyl)-methyl]-N2-cyano-N1-methylacetamidine (IM 1-5)
- 6-chloronicotinic acid (IC-0)
- N^2-carbamoyl-N^1-((6-chloro-3-pyridyl)-methyl)-N^1-methylacetamidine (IM 1-2)
- 6-chloro-3-pyridylmethano (IM-0)
- N-((6-chloro-3-pyridyl)methyl)-N-methylacetamide (IM 1-3)
- N-[(6-chloro-3-pyridyl)methyl]acetamide (IM 2-3)
- N^1-[(6-chloro-3-pyridyl)methyl]-N^2-cyanoacetamidine (IM 2-1)
- Carbon dioxide

The 2009 new use assessment for acetamiprid identified IM 1-4 as a residue of concern for aquatic animals and it was assumed to have similar toxicity to the parent[11] (USEPA, 2009, DP364328). The IM 1-4 degradate was present at a maximum concentration of 73% in aerobic soil metabolism studies and was observed at maximum concentrations at the end of the study. Limited environmental fate data on IM 1-4 suggest that degradation of IM 1-4 is much slower than that of the parent; with parent plus IM 1-4 with representative model input half-live values ranging from less than 30 to 36 days in aerobic soil systems and 178 to 308 days in aerobic aquatic systems. The ecological risk assessment is being completed for parent plus IM 1-4; additionally, it will be characterized whether LOCs would be exceeded for parent alone. Sorption data are not available for IM 1-4; however, EPIWEB 4.1 predicts sorption coefficients for IM 1-4 to be in the same range as those measured for parent. Additional information on transformation products is available in **Appendix A**.

Previously unextracted residues were considered an uncertainty in the exposure assessment. Additional data were submitted that were determined to have adequate extraction techniques and the small percentages of unextracted residues in the newly submitted studies could be considered bound and unavailable for exposure (MRID 49734002, 49734003, 49734004). The previously submitted studies were not considered appropriate to develop model inputs without considering the uncertainty in the unextracted residues because a range of polar and nonpolar solvents were not utilized in the extraction procedures (MRIDs 46255603, 44651881, 44699101, 44651879, 44988513, 49034201, 44988512).

Table 10 summarizes representative half-life values for model inputs from laboratory degradation data for parent and parent plus IM 1-4. These values often are different from the actual time to 50 percent decline of the residues as degradation kinetics were often biphasic with the rate of degradation slowing over time. **Figure 1** provides example decline curves from an aerobic soil and aerobic aquatic metabolism study where this occurred. The representative half-life for model input is designed to provide

[11] See **Section 4.4** for a description of the toxicity data available for degradates.

a representative estimate of exposure when assuming a single first order decline curve in modeling, when datasets are not well defined by the single first order model. Actual DT_{50} and DT_{90} values for each study are provided in **Appendix A.**

Table 10. Summary of Environmental Degradation Data for Acetamiprid and Acetamiprid plus IM 1-4

Study	System Details	Representative Half-life to Derive Model Input (days)[1,2]		MRID or Reference/ Comment
		Parent	Parent plus IM 1-4	
Abiotic Hydrolysis	pH 5, 7, 9	Stable (SFO)	--	MRID 44651876
Atmospheric Degradation	Hydroxyl Radical	0.14 (SFO)	--	Estimated value. EPIWeb Version 4.1
Aqueous Photolysis	pH 7, 25°C 40°N sunlight	34 (SFO)	--	MRID 44988509
Aerobic Soil Metabolism	IL Loam, 20°C	14.9 (IORE)	69 (DFOP)	MRID 49734002
	GA Sand, 20°C	7.04 (IORE)	337 (DFOP)	
	Sandy loam, 20°C	4.92 (IORE)	383 (DFOP)	
	Sandy loam, 20°C	1.85 (SFO)	331 (DFOP)	
Aerobic Aquatic Metabolism	NC sand, 20°C	96.2 (SFO)	398 (DFOP)	MRID 49734003
	PA silty clay loam, 20°C	86.6 (SFO-LN)	318 (DFOP)	
Anaerobic Aquatic Metabolism	PA Loam, 20°C	585 (SFO)	--	MRID 49734004
	NC sandy loam, 20°C	477 (SFO)	--	

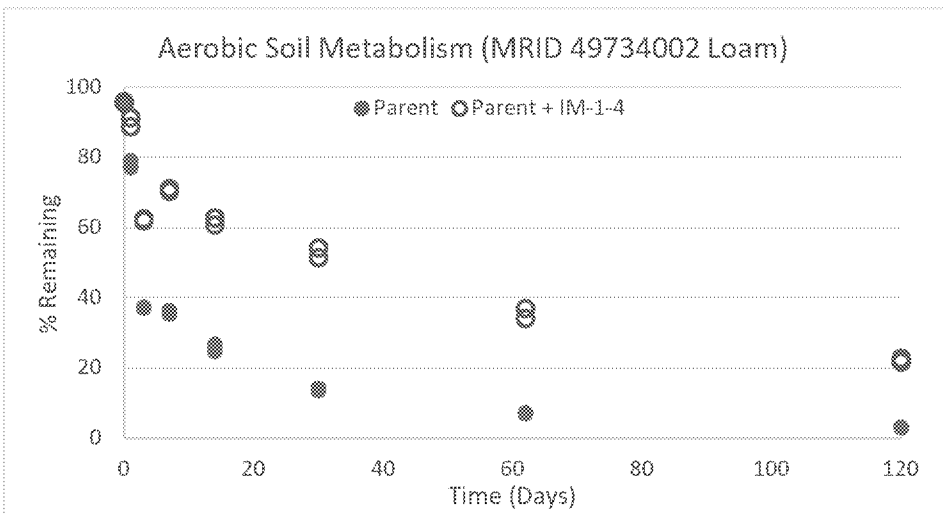
OC=organic carbon; SFO=single first order; DFOP=double first order in parallel; IORE=indeterminate order (IORE); SFO DT_{50}=single first order half-life; T_{IORE}=the half-life of a SFO model that passes through a hypothetical DT_{90} of the IORE fit; DFOP slow DT_{50}=slow rate half-life of the DFOP fit, --=not available or applicable

[1] The value used to estimate a model input value is the calculated SFO DT_{50}, T_{IORE}, or the DFOP slow DT_{50} from the DFOP equation. The model chosen is consistent with that recommended using the, *Guidance for Evaluating and Calculating Degradation Kinetics in Environmental Media (NAFTA, 2012)*. The same kinetic equation used to determine the representative model input value was used to describe the DT_{50} and DT_{90} results based on standard kinetic equations. For the aerobic aquatic silty clay loam and terrestrial field dissipation studies, the natural log transformed single first order model was used to describe the data (SFO-LN).

The natural log transformation of the single-first order model was used to estimate the representative model input value of the aerobic aquatic metabolism for the silty clay loam system parent only resulting in a value of 86.6 days (MRID 49734003). When applying the standard degradation kinetics calculation paradigm, the recommended representative model input is a T_{IORE} value of 895-days for parent only. This results from the dataset being biphasic (see **Figure 1** for a graph of the data) with a loss of 45 to 86% of parent over 14-days followed by either no loss to 14% loss of parent between 14 to 100-days. The representative model input for parent only of 895 days (T_{IORE} value) is longer than the recommended representative model input value of 318 days (slow DFOP) for parent plus IM 1-4 for the same system. The discrepancy of having a longer input value for parent alone as compared to total residues occurs due to the differences in equations used to characterize the data and due to the variability in the dataset. In order to resolve the issue of having a longer parent only model input as compared to the total residue data input, it was decided to use the SFO model to estimate the model input for parent only. The natural log transformation method for estimating the model input was used as it weights the data so that a slightly longer half-life is estimated (86.6 days versus 47.2 days without natural log transformation). The input of 86.6 days was used as it is recognized that the SFO model does not capture the biphasic nature of the decline curve. Whether the 895-day value or the 86.6-day value is used in modeling, the risk conclusion of potential for effects to aquatic invertebrates does not change. The data set for the parent is highly uncertain due to the variability in the data. The main understanding from this study is that residues of acetamiprid and IM 1-4 undergo an initial decline followed by a very slow degradation rate.

Table 11. Summary of Terrestrial Field Dissipation Data for Acetamiprid

Study	System Details	Dissipation Half-life	MRID or Reference/ Comment
Terrestrial Field Dissipation[2]	CA, Gilman loamy fine, Vinca rosea	2.8	MRID 44988514
	FL, Astatula fine, tree ferns	14.1	
	NJ, Penn silt loam, garden mums	4.2	
	WA, Timerman coarse sandy loam, apples	3	MRID 44988515
	FL, Candler sand soil, oranges	6	
	NY, Oakville loamy fine sand, cabbage	13	
	CA, Romona loam soil, cotton	6	
	Prince Edward Island, Alberry sandy loam	10.1	MRID 44988625
	Ontario, London loam	5.2	
	Manitoba, Ryerson clay loam	17.8	



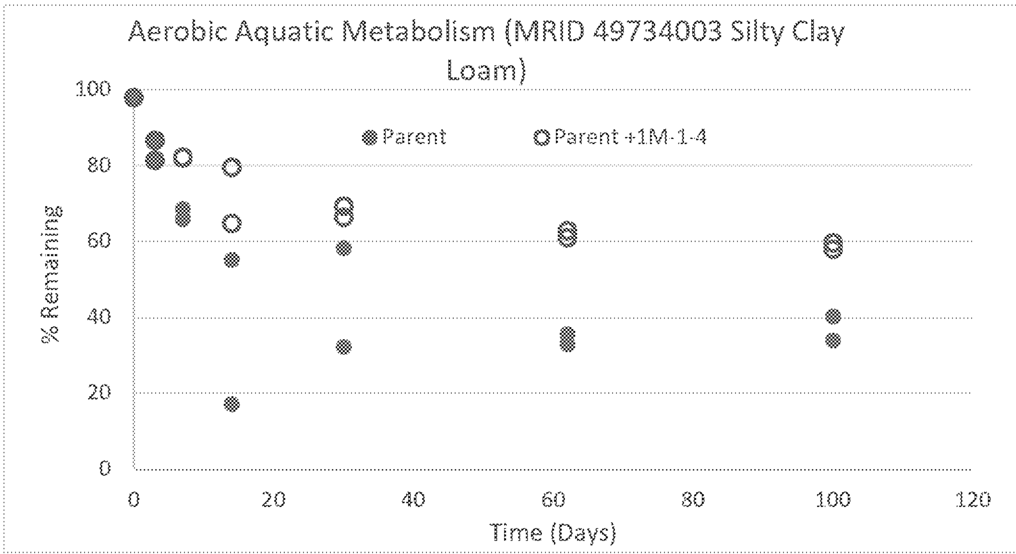


Figure 1. Example aerobic soil metabolism and aerobic aquatic metabolism degradation curves for acetamiprid and IM 1-4

3.2. Measures of Aquatic Exposure

3.2.A. Aquatic Modeling Input Parameters

Surface water aquatic modeling was simulated using the Pesticide in Water Calculator (PWC version 1.52) for use patterns to terrestrial areas (including applications to cranberries that are dry harvested) and the Pesticides in Flooded Applications Model (PFAM; version 2.0 dated September 27, 2016) for use on cranberries that are grown with intermittently flooded fields. Chemical input parameters used in modeling are presented in **Table 13.** Input parameters were selected in accordance with EFED's guidance documents (USEPA, 2009, 2010b, 2012d, 2013a, 2013b, 2014a, 2014b; USEPA and Health Canada, 2013). See Section 2.6.B of the analysis plan for an explanation of which uses were simulated in aquatic modeling. BEAD provided recommended dates for the first day of application simulated for each simulated crop for most simulated use patterns (see **Table 15**).

The uses on agricultural crops allow for ground, aerial, and airblast applications of a flowable material. For the agricultural crop uses, EECs for broadcast aerial, airblast (for tree and orchard crops), and ground spray applications were generated using a batch processing input file. The application method resulting in the highest EEC is shown in the results table in this section.

Since the previous ecological risk assessment was completed there are several updates to the aquatic modeling approach. New aerobic soil metabolism, aerobic aquatic metabolism, and anaerobic aquatic metabolism data are available that reduced uncertainty in the unextracted residues. These new data were incorporated into the risk assessment and resulted in some changes in the aquatic modeling inputs. **Table 12** summarizes the changes in the model input parameters from those used in previous risk assessments. Additionally, it is now recommended that the daily average value be used to calculate acute risk quotients for aquatic organisms rather than the peak value used in previous risk assessments (USEPA, 2017c). The model inputs generally increased with the newly available data because the newly available data generally resulted in higher representative half-life inputs than previously calculated values.

Labels include specification of the number of crop cycles per year for uses on berries. Modeling was completed using standard scenarios, which only simulate crop parameters for one crop cycle per year.

Application dates were chosen to be consistent with the season where the crop is produced for the area. Applications may have occurred outside of the dates that the PWC simulates for the crop on the field.

Simulations for applications in residential areas and structural treatments assumed that only a portion of a lot would be treated, that only a portion of the watershed contained residential lots, and that between 1 and 58 houses in the watershed were treated. The methodology used in this assessment is consistent with the methodology used for residential applications of pyrethroids. Additional details are provided in **Appendix F**.

Table 12. Summary of Changes in Aquatic Model Inputs between the 2015 Assessment and the current Preliminary Risk Assessment (PRA)

Aquatic Modeling Input Parameter	Half-Life Input for Different Residues (days)		
	Parent	Parent + IM 1-4	Parent + Unextracted + IM 1-4
Aerobic Soil (PRA)	12	397	Not Simulated
Aerobic Soil (2015)	2.4	192	540
Aerobic Aquatic (PRA)	106	481	Not Simulated
Aerobic Aquatic (2015)	24	266	488

Table 13. Aquatic Modeling Input Parameters for Residues of Acetamiprid Alone and Acetamiprid Plus IM 1-4 (designated with an i)

Parameter (units)	Value (s)	Source	Comments
K_{OC} (mL/g)	227.2	MRID	Average of 5 values for parent. The coefficient of variation was 27% for K_{OC} and 66% for K_d. EPIweb 4.1 estimated K_{OC} values for IM 1-4 that are within the range of measured parent K_{OC} values for parent.
Water Column Metabolism Half-life (days) at 20°C	481 i 106	MRID 49734003	Represents the 90 percent upper confidence bound on the mean (91.4 and 358) of 2 representative half-life values.
Benthic Metabolism Half-life (days) at 20°C	697	MRID 49734004	Represents the 90 percent upper confidence bound on the mean (531) of 2 representative half-life values. As parent was stable, a separate value was not calculated for parent plus IM 1-4.
Aqueous Photolysis Half-life @ pH 7 (days)	34 at 40°N	MRID 44988509	One measured value for parent.
Hydrolysis Half-life (days)	0	MRID 44651876	No significant degradation observed at 25°C.
Soil Half-life (days) at 20°C	397 i 12	MRID 49734002	Represents the 90 percent upper confidence bound on the mean (7 and 280) of 4 representative half-life values.
Foliar Half-life	--		No Data
Molecular Weight (g/mol)	222.68	--	--
Vapor Pressure (Torr) at 25°C	7.5×10^{-10}	--	Vapor pressure for parent
Solubility in Water (mg/L)	4250	--	20°C and pH 7, measured value for parent
Heat of Henry (J/mol)	45061	--	Calculated from EPIWEB 4.1
Henry Reference Temperature °C	22.5		The vapor pressure was measured at 20°C and the water solubility was measured at 25°C.

Parameter (units)	Value (s)	Source	Comments
Application Efficiency (decimal)	0.99 (ground) 0.95 (aerial)	--	–
Spray Drift Fraction (decimal)	0.125 (aerial) 0.062 (ground) 0.042 (airblast) 0.0 (hand held equipment)	(USEPA, 2013b)	Default spray drift assumptions

PFAM was used to estimate EECs for acetamiprid use on cranberries that are subsequently flooded at harvest and with a winter flood. The PFAM model simulates application of the pesticide to a wet or dry field and degradation in soil and/or water. If the pesticide is applied to dry soil, water may then be introduced into the field and movement of the pesticide may occur from soil into the water.

After flooding, water may be held in a holding system, recirculated to other areas of the cranberry production facility, or released to adjacent waterbodies (canals, rivers, streams, lakes, or bays) external to the cranberry fields. Potential exposure was evaluated for residues in cranberry bog water (*i.e.*, flood water in the treated cranberry field). The cranberry bog water estimates are post-application residues in flood water introduced into the treated cranberry field.

Acetamiprid concentrations in adjacent waterbodies are expected to be lower than those estimated in the cranberry bog water as acetamiprid can potentially degrade in the water column, be adsorbed by sediment, or diluted with uncontaminated water from other sources in the adjacent waterways. The extent of this reduction in concentrations depends on numerous factors including 1) the length of time the compound is in the water, 2) the distance the water travels, 3) the amount of dilution, and 4) whether the release water is mixed with water that also carries residues of acetamiprid. Estimates for the cranberry bog and release water do not account for recycling of water within the cranberry fields. Under some circumstances (*e.g.*, recycled water is retreated with acetamiprid or is flooded onto a cranberry field previously treated with acetamiprid), recycling may lead to greater exposure concentrations upon release of a relatively persistent compound such as acetamiprid and ROC. Release water EECs were calculated based on 30-years of simulated results with two flooding events per year for cranberries (*i.e.*, winter flooding and flooding during harvest). The PFAM applications tab and scenario input parameters are shown in **Table 14** and details of the assumed flood schedule are presented in **Appendix F**.

Table 14. PFAM applications tab and scenario

Parameter	Input Value and Unit	Source/Comments
Cranberry	MA_Cranberry-Winter Flood STD.PFA OR_Cranberry-Winter Flood STD.PFA WI_Cranberry-Winter Flood STD.PFA	Interim standard scenarios *See* flood schedule assumptions in **Appendix D**
Maximum single application rate	0.13 lb ai/A (0.15 kg ai/HA), 2x	PLUS report
Application Dates	June 1 and Jun 8	PLUS report and recommendations from cranberry pest management to apply in June or July (Guedot *et al.*, 2017)
Slow Release (1/day)	0	Applied as a flowable. Slow release is not expected to occur.
Drift Factor	Not applicable	Not applicable

3.2.A.i. Aquatic Modeling Results

The 1-in-10 year EECs of acetamiprid residues were estimated for parent alone and parent plus IM 1-4 residues. The EECs for parent and IM 1-4 characterize exposure assuming that the toxicity of parent and IM 1-4 is similar. Comparison with EECs for the parent alone may be used to better understand the uncertainty in the EECs due to using a TTR approach. See **Section 3.4.A** for a discussion of the toxicity data for degradates.

Daily average, 21-day, and 60-day EECs for the combined parent plus IM 1-4 were all very similar for each individual scenario and PWC model run. The highest EECs across PFAM and PWC simulations occurred for cranberries with the daily average, 21-day average, and 60-day average EECs ranging from 34.0 to 37.2 µg/L. The daily average, 21-day average, and 60-day average EEC for applications to strawberries resulted in the highest PWC EECs of 32.7, 31.6, and 30.4 µg/L, respectively. All EECs for parent plus IM 1-4 ranged from <0.01 to 37.2 µg/L. The use scenario for low growing berries (represented by FLstrawberry_wirrigSTD PRZM scenario) resulted in the highest PWC EECs (across residential and agricultural aquatic modeling) based on an application scenario of 0.13 lbs a.i./A applied twice per season with a seven-day retreatment interval and three seasons of applications. Pore-water EECs were 71 to 93% of water-column EECs demonstrating that exposure may occur in both the water-column and pore-water. While most of the acetamiprid present in the benthic region is expected to be sorbed, the estimated pore-water fraction reflects acetamiprid residues that are dissolved in pore-water and may be bioavailable (USEPA, 2014c).

Table 15. Surface Water EECs for Acetamiprid plus IM 1-4 (Estimated Using PWC version 1.52 and PFAM version 2.0)

Use	PWC Scenario	First Day of App (Month/ Day)	Application Scenario[2]	1-in-10 year EEC (µg/L)				
				Water Column			Pore-Water	
				1-day	21-day	60-day	Peak[1]	21-day
Cotton	CAcotton_wirrig STD	5/1	0.15 (0.17), 2x, 0.1 (0.11), 1x, 7 d	6.09	5.89	5.61	4.65	4.65
	MScottonSTD	7/1		17.6	17	15.9	13.2	13.3
	NCcottonSTD	9/1		27.5	27.1	26.4	24.3	24.2
Pome Fruit	NCappleSTD	6/1	0.15 (0.17), 4x, 12 d	19.2	18.7	17.8	15.6	15.6
	ORappleSTD	6/1		15.3	15	14.5	13.4	13.4
	PAappleSTD_v2 STD	5/15		24	23.3	22.2	21.1	21.2
	CaFruit_wirrigS TD	4/1		9.87	9.59	9.17	7.87	7.86
Citrus	CAcitrus_Wirrig STD	3/1	0.25 (0.28), 2x, 7d, 0.05 (0.06), 1x	8.41	8.22	7.9	6.74	6.73
	FLcitrusSTD	9/1		24.2	23.4	22	18.6	18.6
	FLcitrusSTD	9/1	0.11 (0.12), 5x, 7 d	24.9	24.2	23.1	18.9	18.9
Tree Nuts	CAalmond_Wirr igSTD	2/15	0.18 (0.20), 4x, 0.72, 14 d	14.1	13.9	13.4	11.8	11.8
	ORfilbertSTD	6/1		17.6	17.2	16.8	15.6	15.6
	GApecanSTD	6/1		22.3	21.6	20.9	17.7	17.8
Fruiting Vegetables	FLcucumberSTD	Day of Emergence	0.15 (0.17), 1x,0.075 (0.084) 4x, 7 d	23.4	24	21.7	17.2	16.8
Leafy Vegetables	CALettuceSTD			18.5	18.2	17.8	15.8	15.8
	FLcabbageSTD			13.1	12.7	12	9.57	9.53

Use	PWC Scenario	First Day of App (Month/ Day)	Application Scenario[2]	1-in-10 year EEC (µg/L)				
				Water Column			Pore-Water	
				1-day	21-day	60-day	Peak[1]	21-day
13-07-G Low Growing Berry Subgroup (including cranberries)	Flstrawberry_WirrigSTD	2/15, 2/22, 5/15, 5/22 8/15, 8/22	0.13 (0.15), 2x, 7 d in February, May, and August[3]	32.6	31.6	30.4	26.8	26.7
	CAstrawberry-noplasticRLFV2			25.5	25.1	24.7	22.8	22.8
	ORberriesOP	4/1	0.13 (0.15), 2x, 7 d[4]	18.5	18.2	17.9	17.2	17.2
	Flstrawberry_WirrigSTD	2/15		10.8	10.5	9.97	8.02	8.01
Ornamentals	CAnurserySTD_V2	3/1	0.52 (0.58), 1x, 0.03 (0.033), 1x, 7 d[5]	13.4	13	12.5	11	11
	FLnurserySTD_V2	6/1		28.4	27.5	25.7	20.4	20.4
	MInurserySTD_V2	6/1		20.7	20.3	19.7	17.7	17.7
	NJnurserySTD_V2	6/1		17	16.6	16	13.7	13.7
	ORnurserySTD_V2	6/1		14	13.9	13.6	12	12
	TNnurserySTD_V2	7/1		16.1	15.8	15	12.5	12.6
Cranberry	MA_Cranberry-Winter Flood STD.PFA	7/1	0.13 (0.15), 2x, 7 d	32.2	30.7	29.2	--	--
	OR_Cranberry-Winter Flood STD.PFA	7/1		21.3	19.7	18.1	--	--
	WI_Cranberry-Winter Flood STD.PFA	7/1		37.3	36.4	34	--	--
Potato Seed Treatment	IDNpotato_WirrigSTD		0.20 (0.22), 1x, ^, 12.7 cm	<0.01	<0.01	<0.01	--	--
Canola Seed Treatment	NDcanolaSTD		0.20 (0.22), 1x, ^, 1.27 cm	<0.05	<0.05	<0.05	<0.05	<0.05

^ Pesticide mass is distributed in the soil linearly increasing with depth down to the depth specified by the user. This was used as a screening assumption for the seed treatment use pattern. A formal policy on modeling seed treatment is currently under development.

[1] The daily average benthic pore-water EEC is expected to be almost identical to the peak EEC.

[2] The application scenario is provided in lbs a.i./A (kg a.i./ha), number of applications, followed by the minimum retreatment interval in days (d). Results are shown assuming an aerial application scenario unless otherwise specified.

[3] Two applications were assumed to occur in February, May, and August to simulation multiple crop seasons per year.

[4] One simulation for berries with one crop cycle per year was simulated as multiple crop cycles per year is not expected to occur for all berries.

[5] In this scenario one application was simulated at 0.52 lb a.i./A and one application was simulated at 0.03 lbs a.i./A.

Table 17 summarizes EECs when considering different ROC, crop cycles, and drift assumptions. Daily average, 21-day, and 60-day EECs for the parent plus IM 1-4 were also very similar within a single model run and ranged from 24.2 to 27.5 µg/L for the North Carolina cotton simulation. EECs of parent alone for cotton range from 7.01 to 10.3 µg/L. The combined parent plus IM 1-4 EECs were 1.8 to 3.6 times the EECs for parent alone (see **Appendix H**). Surface water EECs increased from approximately 11 µg/L assuming one season per year to 33 µg/L when assuming three seasons per year as permitted on the label for berries (**Table 17**). It is uncertain whether multiple seasons per year would actually occur as most berries are expected to be planted only one season per year. Some labels require a medium drop size distribution (DSD) for both aerial and ground applications. EECs simulated for ground applications assuming a fine to medium coarse DSD[12] (1.7% spray drift fraction) were 37 to 93% of EECs assuming the default very fine to fine DSD (6.2% spray drift fraction). For aerial applications, EECs assuming a medium to coarse DSD (8.9% spray drift fraction) were 73 to 94% of EECs assuming the default fine to medium DSD (12.5% spray drift fraction). EECs simulated assuming no spray drift occurred were 15 to 92% of EECs assuming spray drift did occur for the ground simulations, these values may be used to understand the potential impact of implementing any spray drift mitigation. The results for the cotton scenario reflect a scenario where transport was not driven by spray drift.

Table 16. Analysis of Different Aquatic Modeling Parameters and the Impact on Surface Water EECs Shown for Cotton and Berries (Estimated Using the PWC version 1.52)

Residues	Application Efficiency, Spray Drift Assumption, Seasons	Estimated Environmental Concentration (EEC) µg/L			
		Surface Water			Pore Water
		1-day	21-day	60-day	21-day
Residues Considered – Cotton - Aerial					
Parent	0.95, 0.125	10.3	9.83	8.93	7.01
Parent+1M-1-4	0.95, 0.125	27.5	27.1	26.4	24.2
Runoff and Spray Drift Contribution – Cotton - Ground					
Parent+IM 1-4	0.99, 0.062 [1]	25.4	25.0	24.8	22.5
Parent+IM 1-4	0.99, 0 [1]	22.5	22.2	22.2	20.2
Seasons Per Year – Berries - Aerial					
Parent+IM 1-4	0.95, 0.125, 3cc	32.7	31.6	30.4	26.7
Parent+IM 1-4	0.95, 0.125, 1cc	10.8	10.5	9.97	8.01

CC=crop cycle
[1] This simulation was completed to explore the impact of drift on the EECs as some labels have drift restrictions. The influence of drift is specific to each individual scenario. A ground application was simulated because it has a higher application efficiency as compared to aerial applications.

Table 17. Analysis of Different Aquatic Modeling Parameters and the Impact on Surface Water EECs Shown for Cotton and Berries (Estimated Using the PWC version 1.52)

Residues	Application Efficiency, Spray Drift Assumption, Seasons	Estimated Environmental Concentration (EEC) µg/L			
		Surface Water			Pore Water
		1-day	21-day	60-day	21-day
Residues Considered – Cotton – Aerial					
Parent	0.95, 0.125	10.3	9.83	8.93	7.01
Parent + 1M-1-4	0.95, 0.125	27.5	27.1	26.4	24.2
Runoff and Spray Drift Contribution – Cotton - Ground					
Parent + IM 1-4	0.99, 0.062 [1]	25.4	25.0	24.8	22.5
Parent + IM 1-4	0.99, 0 [1]	22.5	22.2	22.2	20.2
Seasons Per Year – Berries – Aerial					
Parent + IM 1-4	0.95, 0.125, 3cc	32.7	31.6	30.4	26.7
Parent + IM 1-4	0.95, 0.125, 1cc	10.8	10.5	9.97	8.01

CC=crop cycle
[1] This simulation was completed to explore the impact of drift on the EECs as some labels have drift restrictions. The influence of drift is specific to each individual scenario. A ground application was simulated because it has a higher application efficiency as compared to aerial applications.

[12] Standard options in AGDRIFT for modeling spray drift for ground applications include: very fine to fine and fine to medium/coarse.

3.2.B. Monitoring Data

The following databases and sources were searched for monitoring information on acetamiprid on September 18, 2017:

- Water Quality Portal (http://www.waterqualitydata.us/portal.jsp)
- California Environmental Data Exchange Network (CEDEN) (http://ceden.waterboards.ca.gov/AdvancedQueryTool)

In the Water Quality Portal, there were 17 reported detections (0.74%) of acetamiprid out of 2,286 surface water samples analyzed for acetamiprid with the maximum detection of 0.227 μg/L. There were 1,834 groundwater samples analyzed for acetamiprid, and acetamiprid was not detected in any of the samples. The limit of quantitation (LOQ) ranged from 0.003 to 0.025 μg/L. It is unknown whether samples were collected in areas where acetamiprid is used; however, acetamiprid is used heavily in the central valley of California and there were no detections reported in CEDEN a database of monitoring data collected in California.

Hladick *et al.* (2014) collected 79 surface water samples from nine streams in a high corn and soybean producing area during the growing season in 2013. Acetamiprid had lower usage as compared with other neonicotinoids evaluated in the study, and only had one detection at 11.1 ng/L in Little Sioux River. Method detection limits ranged from 0.004 to 0.006 μg/L.

Anderson *et al.* (2013) evaluated water quality of the playas[13] and monitored pesticides applied to cotton in the Southern High Plains of Texas. Water samples (n=109) were collected from twelve playas that contained water at the beginning of the growing season in 2005. Sediment samples were collected in April and December. Acetamiprid was detected in 17% of samples at a mean concentration of 2.2 μg/L (maximum concentration detected was 44.1 μg/L in the crop playas). In the grassland playas, acetamiprid was detected in 4% of samples at a maximum concentration 26.7 μg/L. The exact limit of detection (LOD) was not reported for each individual analyte examined in the study; however, the LOD concentrations assumed for calculations was 0.1 μg/L. Monitoring results are summarized in **Table 18.**

Table 18. Summary of Monitoring Results for Acetamiprid

Source of Information	Type of Study	Frequency of Detections (detections/number of samples)	Method Limit of Detection (μg/L)	Mean (SD)	Maximum Detection (μg/L)
Surface Water					
Water Quality Portal	Non-targeted	<1% (17/2286)	0.003 to 0.025	--	0.227
Anderson et al. 2013	Cotton use area in Texas	17% (19/108)	0.1 μg/L	2.2 (7.3)	44.1
Hladik et al. 2014	Low use area	1% (1/79)	0.004 to 0.006	--	0.0111
Groundwater					
Water Quality Portal	Non-targeted	0% (0/1834)	0.003 to 0.025	--	Not detected

SD=standard deviation

[13] Playas are undrained dry lake beds at the bottom of a desert basin, which periodically fill with water to form a temporary lake.

Except for the Anderson *et al.* (2013) study, most monitoring studies were not specifically targeted at acetamiprid and the frequency of sample collection in all studies was not adequate to ensure the capture of peak concentrations. Monitoring data are useful in that they provide some information on the occurrence of acetamiprid in the environment under existing usage conditions. However, the measured concentrations should not be interpreted as reflecting the upper end of potential exposures. Absence of detections from non-targeted monitoring cannot be used as a line of evidence to indicate exposure is not likely to occur because data are often collected in areas where the pesticide is not used. Additionally, monitoring results cannot be directly compared to modeling results, as the monitoring does not reflect the modeled conceptual model and the sampling frequency and duration do not reflect what are simulated in modeling. However, the monitoring data provide a useful line of evidence to explore whether exposure in the environment is occurring at the levels of the modeled EECs and whether monitoring shows that exposure is occurring at levels that are higher than toxicity endpoints. If exceedances are not occurring this is not evidence that exceedances will not occur with usage; however, if there are exceedances, it confirms that exposure has been confirmed in the environment at levels where effects are expected to occur. It also provides a line of evidence on whether the EECs estimated with modeling are occurring in the environment.

3.3. Measures of Terrestrial Exposure

3.3.A. Ingestion of Surface Residues by Birds and Mammals

For terrestrial animals, the Terrestrial Residue Exposure (T-REX) model (Version 1.5.2)[14] is used to calculate dietary- and dose-based EECs for mammals and birds feeding on various food sources at the site of application. Upper-bound Kenaga nomogram values based on Hoerger and Kenaga (1972) as modified by Fletcher *et al.* (1994) are used to derive EECs for acetamiprid exposures to mammals and birds for dietary- and dose-based exposures. A one-year time period is simulated, and input values include the maximum single application rate, maximum number of applications, and minimum retreatment interval for a given use; relevant T-REX inputs and resulting EECs for various crop uses are given in **Table 19** (also see **Appendix C** for sample T-REX input and output screens). EECs are calculated for different types of feeding strategies for mammals and birds, including herbivores, insectivores and granivores. For dose-based exposures, three weight classes of mammals (15, 35, and 1000 g) and birds (20, 100, and 1000 g) are considered. For more information on estimating exposure to terrestrial organisms, see the T-REX User's Guide[15] (USEPA, 2012e).

Table 19 summarizes likely exposure to terrestrial organisms from consumption of dosed food items for six agricultural acetamiprid use scenarios, and a single ornamental[16] acetamiprid use scenario. All of the scenarios were modeled with the assumption of a single crop cycle per year, with the exception of the "low growing berry subgroup (13-07-G)" scenario (which was identical to the "cranberry" scenario), which was modeled for both one and three crop cycles per year. Data from acute and sub-acute dietary studies with Zebra finch were the most sensitive endpoints for these study types, and so the actual weight of birds in the studies must be considered for T-REX modeling. For the acute toxicity study (MRID 48407701), the range of bird weights was 10.2-16.2 mg, and the mean (which was used as the model input) was 13.2 mg. For the sub-acute dietary study, the range of bird weights was 13.5-15.2 mg, and the

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[14] Available at: http://www2.epa.gov/pesticide-science-and-assessing-pesticide-risks/models-pesticide-risk-assessment#terrestrial
[15] Available at: http://www2.epa.gov/pesticide-science-and-assessing-pesticide-risks/t-rex-version-15-users-guide-calculating-pesticide
[16] Acetamiprid may be applied to ornamentals grown in an horticultural setting (*i.e.*, for production) and in a residential setting.

mean (which was used as the model input) was 14.4 mg. As no data are available with which to estimate a foliar dissipation rate, the default 35-day foliar dissipation half-life was used for primary T-REX modeling. The 35-day foliar dissipation half-life was assumed to be largely protective of residues of both parent and IM-1-4. Additional characterizations were conducted to evaluate the influence of shorter foliar dissipation half-lives on risk to terrestrial animals from acetamiprid exposure (Section **4.2.B**).

There are three seed treatment uses (canola/rape seed, mustard seed, and seed piece potatoes) for which risk to terrestrial organisms was also modeled using T-REX (**Table 20**). For these uses, the label (EPA Reg. No. 8033-95) lists application rates directly in fl oz product/100 lbs seed (or fl oz product/cwt), which is the required application rate input for T-REX seed treatment modeling. For the canola and spring mustard seed scenarios, the T-REX default maximum seeding rates of 6 and 7 lbs/A, respectively, were used in modeling, along with a maximum application rate of 15.4 fl oz product/cwt (or 0.03 lbs a.i./A) for both crops. For the seed piece potatoes scenario, a label-based seeding rate of 2000 lbs/A was used as this was the basis of the calculated acetamiprid application rate for this use, along with a maximum application rate of 0.3 fl oz product/cwt (or 0.54 lbs a.i./A). Canola and mustard seeds were assumed to weigh on average 1 X 10^{-5} lbs/seed (4.5 mg/seed)[17], which assuming seeding rates of 6 and 7 lbs seeds/A, respectively, results in an average of 604889 and 705556 seeds/A, respectively. Given acetamiprid application rates of 0.03 lbs a.i./A for both crops, this results in estimates of 4.85 X 10^{-8} and 4.19 X 10^{-8} lbs (2.2 X 10^{-5} and 1.9 X 10^{-5} g) acetamiprid/seed, respectively, for canola and mustard seeds.

[17] Canola seed weight source: 4.5 mg was selected based on data reported by the Canola Council of Canada (www.canolacouncil.org) indicating that most seeds on the market were 3-6 mg. Mustard seed weight source: 4.5 mg was selected based on data from Kew Royal Botanic Gardens' Seed Information Database (data.kew.org/sid) for *Brassica hirta*.

Table 19. T-REX calculated Estimated Environmental Concentrations (EECs; Upper-Bound Kenaga Values) as Food Residues for Terrestrial Animals Based on the Evaluated Acetamiprid Uses and Using the 35-day Foliar Dissipation Half-life.

Food Type	Dietary-Based EEC (mg/kg-diet)	Dose-Based EEC (mg/kg-body weight)					
		Birds			Mammals		
		Small (20 g)	Medium (100 g)	Large (1000 g)	Small (15 g)	Medium (35 g)	Large (1000 g)
Citrus: 2x 0.249 lbs a.i./A, 1x 0.052 a.i./A, 7-day interval							
Short grass	111.78	127.31	72.60	32.50	106.58	73.66	17.08
Tall grass	51.23	58.35	33.27	14.90	48.85	33.76	7.83
Broadleaf plants/small insects	62.88	71.61	40.84	18.28	59.95	41.43	9.61
Fruits/pods/(seeds, dietary only)	6.99	7.96	4.54	2.03	6.66	4.60	1.07
Arthropods	43.78	49.86	28.43	12.73	41.74	28.85	6.69
Seeds (granivore)	NA	1.77	1.01	0.45	1.48	1.02	0.24
Cotton: 4x 0.101 lbs a.i./A, 7-day interval							
Short grass	79.51	90.78	51.76	23.18	75.99	52.52	12.18
Tall grass	36.53	41.61	23.73	10.62	34.83	24.07	5.58
Broadleaf plants/small insects	44.83	51.06	29.12	13.04	42.75	29.54	6.85
Fruits/pods/(seeds, dietary only)	4.98	5.67	3.24	1.45	4.75	3.28	0.76
Arthropods	31.22	35.55	20.27	9.08	29.76	20.57	4.77
Seeds (granivore)	NA	1.26	0.72	0.32	1.06	0.73	0.17
Leafy & Fruiting Vegetables: 1x 0.15 lbs a.i./A, 3x 0.075 lbs a.i./A, 7-day interval							
Short grass	71.06	80.93	46.15	20.66	67.75	46.83	10.86
Tall grass	32.57	37.09	21.15	9.47	31.05	21.46	4.98
Broadleaf plants/small insects	39.97	45.52	25.96	11.62	38.11	26.34	6.11
Fruits/pods/(seeds, dietary only)	4.44	5.06	2.88	1.29	4.23	2.93	0.68
Arthropods	27.83	31.70	18.08	8.09	26.54	18.34	4.25
Seeds (granivore)	NA	1.12	0.64	0.29	0.94	0.65	0.15
Low Growing Berries & Cranberries: 2x 0.131 lbs a.i./A, 7-day interval							
Short grass	58.81	66.98	38.19	17.10	56.07	38.75	8.98
Tall grass	26.95	30.70	17.51	7.84	25.70	17.76	4.12
Broadleaf plants/small insects	33.08	37.68	21.48	9.62	31.54	21.80	5.05
Fruits/pods/(seeds, dietary only)	3.68	4.19	2.39	1.07	3.50	2.42	0.56
Arthropods	23.03	26.23	14.96	6.70	21.96	15.18	3.52
Seeds (granivore)	NA	0.93	0.53	0.24	0.78	0.54	0.12
Low Growing Berries (3 crop cycles)[1]: Per CC – 2x 0.132 lbs a.i./A, 1x 0.032 lbs a.i./A, 7-day interval							
Short grass	71.59	81.53	46.49	20.81	68.25	47.17	10.94
Tall grass	32.81	37.37	21.31	9.54	31.28	21.62	5.01
Broadleaf plants/small insects	40.27	45.86	26.15	11.71	38.39	26.53	6.15
Fruits/pods/(seeds, dietary only)	4.47	5.10	2.91	1.30	4.27	2.95	0.68

Food Type	Dietary-Based EEC (mg/kg-diet)	Dose-Based EEC (mg/kg-body weight)					
		Birds			Mammals		
		Small (20 g)	Medium (100 g)	Large (1000 g)	Small (15 g)	Medium (35 g)	Large (1000 g)
Arthropods	28.04	31.93	18.21	8.15	26.73	18.48	4.28
Seeds (granivore)	NA	1.13	0.65	0.29	0.95	0.66	0.15
Ornamentals: 1x 0.52 lbs a.i./A, 1x 0.03 lbs a.i./A, 7-day interval							
Short grass	124.80	142.13	81.05	36.29	118.99	82.24	19.07
Tall grass	57.20	65.15	37.15	16.63	54.54	37.69	8.74
Broadleaf plants/small insects	70.20	79.95	45.59	20.41	66.93	46.26	10.73
Fruits/pods/(seeds, dietary only)	7.80	8.88	5.07	2.27	7.44	5.14	1.19
Arthropods	48.88	55.67	31.75	14.21	46.60	32.21	7.47
Seeds (granivore)	NA	1.97	1.13	0.50	1.65	1.14	0.26
Pome Fruit: 4x 0.15 lbs a.i./A, 12-day interval							
Short grass	104.41	118.92	67.81	30.36	99.55	68.80	15.95
Tall grass	47.86	54.50	31.08	13.91	45.63	31.53	7.31
Broadleaf plants/small insects	58.73	66.89	38.14	17.08	56.00	38.70	8.97
Fruits/pods/(seeds, dietary only)	6.53	7.43	4.24	1.90	6.22	4.30	1.00
Arthropods	40.90	46.58	26.56	11.89	38.99	26.95	6.25
Seeds (granivore)	NA	1.65	0.94	0.42	1.38	0.96	0.22
Tree Nuts: 4x 0.18 lbs a.i./A, 14-day interval							
Short grass	119.56	136.16	77.65	34.76	113.99	78.78	18.27
Tall grass	54.80	62.41	35.59	15.93	52.24	36.11	8.37
Broadleaf plants/small insects	67.25	76.59	43.68	19.55	64.12	44.31	10.27
Fruits/pods/(seeds, dietary only)	7.47	8.51	4.85	2.17	7.12	4.92	1.14
Arthropods	46.83	53.33	30.41	13.62	44.64	30.86	7.15
Seeds (granivore)	NA	1.89	1.08	0.48	1.58	1.09	0.25

[1] Crop cycles were assumed to begin in February, May and August.

Table 20. Avian and Mammal Dose-Based Estimated Environmental Concentrations (EECs; Nagy Doses) and mg a.i./ft^2 EECs for Acetamiprid-Treated Seed Uses

Birds				
Crop	**Small (20 g)**	**Med (100 g)**	**Large (1000 g)**	**mg a.i./ft^2**
Canola	1014.59	578.56	259.03	0.34
Mustard	1014.59	578.56	259.03	0.29
Potato	19.76	11.27	5.05	5.68
Mammals				
Crop	**Small (15 g)**	**Med (35 g)**	**Large (1000 g)**	**mg a.i./ft^2**
Canola	849.35	587.02	136.10	0.34
Mustard	849.35	587.02	136.10	0.29
Potato	16.55	11.44	2.65	5.68

3.3.B. Exposure to Honey Bees

Potential risk to bees is assessed in this document according to the tiered process described in the *Guidance for Assessing Pesticide Risks to Bees (USEPA et al., 2014)*. As part of the Tier I risk assessment, exposure is estimated in pollen and nectar using generic residue data generated from other chemicals as well as other plant parts **Table 21**.

For dietary exposures resulting from foliar applications, it is assumed that pesticide residues on tall grass (from the Kenaga nomogram of T-REX) are a suitable surrogate for residues in pollen and nectar of flowers that are directly sprayed during application. For contact exposure, exposure is based on the work of Koch and Weißer (Koch and Weisser, 1997) for residues in bees following foliar treatment exposures. For soil applications, pesticide concentrations in pollen and nectar are assumed to be consistent with chemical concentrations in the xylem (stems) of barley (calculated using the modified Briggs' model). For seed treatments, pesticide concentrations in pollen and nectar are based on concentrations in leaves and stems of treated plants (based on the European and Mediterranean Plant Protection Organization (EPPO) default value discussed in the White Paper), assumed to be 1 milligram per kilogram (mg/kg) or 1 part per million (ppm).

The Tier I method is intended to generate "reasonably conservative" estimates of pesticide exposure to honey bees. The Tier I exposure method is intended to account for the major routes of pesticide exposure that are relevant to bees (*i.e.*, through diet and contact). Exposure routes for bees differ based on application type. Under the approach used in this assessment, bees foraging in a field treated with a pesticide through foliar spray could potentially be exposed to the pesticide through direct spray, *i.e.*, contact, as well through consuming acetamiprid residues in pollen and nectar. **Table 21** summarizes estimated environmental exposure concentrations for honey bees for the Tier I assessment, based on the maximum application rate for the ornamental use (*i.e.*, 0.52 lbs ai/A).

Table 21. Estimated Environmental Concentrations (EECs) for Honey bees (*Apis mellifera*) Based on the Highest Foliar Application Use for Ornamentals in Table 2 [1]

Use	**Appl. rate (lbs a.i./A)**	**Exposure Route**	**Life-stage**	**EEC (µg a.i./bee/day)**
Ornamentals	0.52	Contact	Adults	1.40
		Diet	Adults	16.70
			Brood	7.09

[1] Calculations:
Contact adults: APP * (2.7 µg a.i./bee)

Diet adults: APP * (110 μg a.i /g) * (0.292 g/day)
Diet brood: APP * (110 μg a.i /g) * (0.124 g/day)
APP = application rate in lbs a.i./A; based on food consumption rates for larvae (0.124 g/day) and adult (0.292 g/day) worker bees and concentration in pollen and nectar.

3.3.C. Exposure to Terrestrial Plants

TerrPlant[18] (Version 1.2.2) is used to calculate EECs for estimating exposure to non-listed and listed plant species (both monocots and dicots) in dry and semi-aquatic terrestrial habitats resulting both run-off and spray drift from registered uses of acetamiprid. The previous risk assessment (USEPA, 2015, DP426111+) assessed risk to terrestrial plants following exposure resulting from acetamiprid aerial applications up to 0.15 lbs ai/A. For the purposes of this risk assessment uses representing higher single application rates (*i.e.*, citrus: 0.249 lbs ai/A; and, ornamentals: 0.52 lbs ai/A) are modeled. For aerial applications, the default incorporation depth of ≤1", along with a runoff and spray drift fraction of '0.05' (based on a water solubility value of 4250 ppm) were used for modeling registered uses. For ground applications, the default incorporation depth of ≤1", along with a runoff fraction of '0.05' (based on a water solubility value of 4250 ppm), and a spray drift fraction of '0.01' were used for modeling registered uses. Based on acetamiprid uses, and constraints of the model (*i.e.* TerrPlant can only be run with single applications) modeling was run using two different scenarios: 1) a single application at 0.249 lbs a.i./A; and, 2) a single application at 0.52 lbs a.i./A. EECs calculated by TerrPlant using these two application scenarios (as well as for 0.15 lbs a.i./A [based on the 2015 assessment]) are presented **Table 22**, and an example printout from the TerrPlant model is provided in **Appendix I.**

Table 22. TerrPlant-Calculated Estimated Environmental Concentrations (EECs) from Acetamiprid Labeled Uses for Risk to Terrestrial Plants

Description	Equation[1]	Aerial Application EECs (lbs a.i./A)			Ground Application EECs (lbs a.i./A)		
		0.15	0.249	0.52	0.15	0.249	0.52
Runoff to dry areas	(A/I)*R	0.0075	0.0125	0.026	0.0075	0.0125	0.026
Runoff to semi-aquatic areas	(A/I)*R*10	0.075	0.1245	0.26	0.075	0.1245	0.26
Spray drift	A*D	0.0075	0.0125	0.026	0.0015	0.0025	0.0052
Total for dry areas	((A/I)*R)+(A*D)	0.015	0.0249	0.052	0.009	0.0150	0.0312
Total for semi-aquatic areas	((A/I)*R*10)+(A*D)	0.0825	0.1370	0.286	0.0765	0.1270	0.2652

[1] Terms for equations: 'A' – application rate; 'I' – incorporation rate; 'R' – runoff fraction; and, 'D' – drift fraction.

3.4. Ecological Effects Characterization

The ecological effects characterization for acetamiprid is based upon registrant-submitted toxicity data for the TGAI and formulated products, for which the most sensitive toxicity endpoints are summarized below. A more detailed summary of all submitted data is available in **Appendix B**. Several studies with bees exposed to either the TGAI or formulated acetamiprid have been reviewed since the last risk assessment was issued in 2015 (USEPA, 2012, DP401171). The results of these studies, as well as the

[18] Available at: https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/models-pesticide-risk-assessment#terrestrial.

most sensitive overall endpoints across guideline taxa from both registrant-submitted and acceptable open literature studies, are described briefly in this section.

3.4.A. Aquatic Toxicity Assessment

A summary of the most sensitive toxicity endpoints for aquatic organisms used to generate RQ values is shown in **Table 23.**

The available data indicate that technical grade acetamiprid is practically non-toxic to freshwater fish on an acute exposure basis, with no significant mortality observed in available acute toxicity tests. In a 96-hr flow through toxicity test with rainbow trout (*Oncorhynchus mykiss*; MRID 44651864), mortality did not exceed 20% after exposure to acetamiprid treatments up to 100 mg a.i./L (nominal). The resulting LC_{50} value is therefore non-definitive, *i.e.*, >100 mg a.i./L. A significant ($p<0.05$) decrease in growth (5.3% decrease in length; 17.6% decrease in wet weight) was observed at 38.4 mg a.i./L in a 35-day early life stage toxicity study (MRID 44651872) with fathead minnow (*Pimephales promelas*), resulting in a NOAEC value of 19.2 mg a.i./L.

Available data suggest that technical grade acetamiprid is slightly toxic to estuarine/marine fish on an acute exposure basis, based on a 96-hr flow through toxicity test with sheepshead minnows (*Cyprinodon variegatus*; MRID 44988711). Mortality was 10 and 90% at the highest two test concentrations (90 and 150 mg a.i./L, respectively), resulting in an LC_{50} value of 100 mg a.i./L. No chronic toxicity data were submitted for estuarine/marine fish. Although a freshwater acute-to-chronic ratio (ACR) can sometimes be used to estimate the chronic toxicity value for estuarine/marine organisms in the absence of data, the non-definitive acute toxicity value (LC_{50} >100 mg a.i./L) for freshwater fish, precludes the use of an ACR.

Acetamiprid is very highly toxic to freshwater invertebrates based on two acute toxicity tests, one (MRID 45932501) with the freshwater amphipod, *Gammarus fasciatus*, and the other (MRID 45916201) with the non-biting midge (*Chironomus riparius).* In the former study, mortality was 70% at the highest test concentration (0.14 mg a.i./L), resulting in a 96-hr LC_{50} of 0.080 mg a.i./L. In the latter study, mortality was 100% at the highest two test concentrations (46 and 110 µg a.i./L [as measured in overlying water]), resulting in a 96-hr LC_{50} of 20.9 µg a.i./L. *Chironomus riparius* were exposed to acetamiprid in a static exposure system containing water and 2-3 mm silica sand, and the LC_{50} was calculated relative to the mean-measured acetamiprid concentration in overlying water. Sediment pore water concentrations were not measured, which while being the typical basis for a standard sediment toxicity study, is not appropriate given the specific study conditions. Consistent with previous risk assessments, this endpoint was used to evaluate acute risk in to sediment-dwelling organisms and those in the water-column. However, available data suggests that acetamiprid is likely several orders of magnitude less toxic to true water-column dwelling species such as water fleas (*Daphnia magna*). In an acute toxicity test (MRID 44651866) with *D. magna*, daphnid immobility (*i.e.* mortality) was 20, 45, 85 and 100%, respectively, at 25, 50, 100 and 200 mg a.i./L (nominal), resulting in a 48-hr LC_{50} of 50,000 µg a.i./L. Consequently, acetamiprid was classified as slightly toxic to water fleas on an acute exposure basis.

Although the non-biting midge (*Chironomus riparius)* are the most sensitive freshwater aquatic invertebrate tested with acetamiprid on an acute exposure basis, no chronic toxicity data are available for this species. In a 21-day chronic toxicity study with water flea (*D. magna*), significant ($p<0.05$) adverse effects were observed on growth (decreased length and weight) and reproduction (decreased number of offspring) at all but the lowest two test concentrations, resulting in a LOAEC and NOAEC of 9.0 and 5.0

mg a.i./L, respectively (MRID 446518-71). At the 9.0 mg a.i./L treatment level, mean daphnid body length was reduced by 8%, mean body weight by 24%, and mean number of offspring by 50%. Using the daphnid acute (LC_{50}=50 mg ai/L) and chronic (NOAEC=5.0 mg ai/L) toxicity data, the ACR is 10. Applying this ACR to the acute toxicity endpoint for chironomids results in an estimated NOAEC of 0.002 mg ai/L. Furthermore, although mysid shrimp (*Americamysis bahia*) are an estuarine/marine invertebrate species, they demonstrate acute toxicity more similar to that of chironomids than daphnids, which are relatively insensitive to acetamiprid on acute exposure basis. We can use available acute (LC_{50}=0.066 mg ai/L) and chronic toxicity data (NOAEC=0.0025 mg ai/L) for mysid shrimp to calculate an ACR of 26.4. Applying this ACR to the acute toxicity endpoint for chironomids results in an estimated NOAEC of 0.0008 mg ai/L. The studies with daphnids, midges and mysid shrimp were all with spiked water, and so although midges and mysid shrimp are typically benthic organisms, available study data on the aquatic invertebrates was comparable. Acetamiprid is very highly toxic to estuarine/marine invertebrates based on an acute toxicity test with mysid shrimp (*A. bahia*, MRID 446518-69), in which mortality was 90% at the highest test concentration (110 µg a.i./L), resulting in a 96-hr LC_{50} of 0.066 µg a.i./L. In a 28-day flow-through chronic toxicity study with *A. bahia* (44651873), significant ($p<0.05$) reductions (11%) in male dry body weight were observed at the LOAEC of 4.7 µg a.i./L resulting in a NOAEC of 2.5 µg a.i./L, respectively.

Tier 1 toxicity testing with aquatic plants indicates that acetamiprid is not toxic at the concentrations tested. Exposure to acetamiprid did not significantly affect growth in the single aquatic vascular plant species (*Lemna gibba*, 14-day test) nor four nonvascular plants species at limit concentrations tested ranging from 1.0 to 1.3 mg a.i./L.

Table 23. Summary of Most Sensitive Aquatic Toxicity Endpoints for Acetamiprid Technical Grade Active Ingredient

Species	Measured Effect	Duration	Endpoint (mg a.i./L)	Test Substance (% a.i.)	MRID (Study Classification)
Freshwater Fish					
Oncorhynchus mykiss (Rainbow Trout)	Mortality	96 hours	LC_{50}: >100 (Practically non-toxic)	>99%	44651864 (Acceptable)
Pimephales promelas (Fathead Minnow)	Reduced growth (5.3% decrease in length; 17.6% decrease in wet weight)	35 days	NOAEC: 19.2 LOAEC: 38.4	100%	44651872 (Supplemental)
Estuarine/Marine Fish					
Cyprinodon variegatus (Sheepshead minnow)	Mortality	96 hours	LC_{50}: 100 (Slightly toxic)	99.9%	44988411 (Acceptable)
Freshwater Invertebrates					
Daphnia magna (Waterflea)	Mortality	48 hours	LC_{50}: 50 (slightly toxic)	>99%	44651866 (Supplemental)
Chironomus riparius (Non-biting Midge)	Mortality	48 hours	LC_{50}: 0.021 (Very highly toxic)	99.3	45916201 (Supplemental)

Species	Measured Effect	Duration	Endpoint (mg a.i./L)	Test Substance (% a.i.)	MRID (Study Classification)
Daphnia magna (Waterflea)	Reduced growth (8% decrease in length; 24% decrease in weight)	21-day	NOAEC: 5.0 LOAEC: 9.0	100%	44651871 (Acceptable)
Estuarine/Marine Invertebrates					
Americamysis bahia (Mysid shrimp)	Mortality	96 hours	LC_{50}: 0.066 (Very highly toxic)	99.9%	44651869 (Acceptable)
	Reduced growth (11% decrease in dry weight in males)	28 days	NOAEC: 0.0025 LOAEC: 0.0047	99.9%	44651873 (Acceptable)
Aquatic Vascular Plants					
Lemna gibba (Duckweed)	Frond number	14 days	EC_{50}: >1.0 NOAEC: 1.0	99.9%	44988415 (Acceptable)
Aquatic Non-Vascular Plants					
Navicula pelliculosa (Freshwater diatom)	Cell density	5 days	EC_{50}: >1.1 NOAEC: 1.1	99.9%	44988417 (Acceptable)
Skeletonema costatum (Marine diatom)	Cell density	5 days	EC_{50}: >1.0 NOAEC: 1.0	99.9%	44988418 (Acceptable)

Acute toxicity to aquatic invertebrates was evaluated for several degradates of acetamiprid, and detailed results are reported in **Appendix B**. Toxicity tests on *D. magna* with degradates IC-0 (MRID 44988409), IM-1-2 (MRID 44651867), and IM 1-4 (MRID 44651868) resulted in 48-hr LC_{50} values of >95.1, >99.8, and 43.9 mg a.i./L, respectively, while the *D. magna* 48-hr LC_{50} for the parent compound is 50 mg a.i./L (MRID 44651866) (**Table 24**). These data indicate that IM 1-4 has similar toxicity to the parent for some freshwater aquatic invertebrates (*i.e.*, both are classified as slightly toxic). The 48-hr LC_{50} of IM-1-5 for the non-biting midge (MRID 46255610) is 68 mg a.i./L compared to 0.021 mg a.i./L for parent acetamiprid; therefore, IM 1-5 was not considered a residue of concern.

For estuarine/marine invertebrates, acute toxicity data were only submitted for IM 1-4 on mysid shrimp (MRID 44651870), resulting in an LC_{50} of 19 mg a.i./L compared to the parent compound endpoint value of 0.066 mg a.i./L for the same species. Therefore, the IM I-1-4 degradate is several orders of magnitude less toxic to mysid shrimp on an acute exposure basis than is the parent compound.

Table 24. Most Sensitive Aquatic Invertebrate Acute Toxicity Data for Acetamiprid and Degradates

Species	Test Substance	48-hr LC_{50} (mg a.i./L)	Toxicity Category	MRID	Study Classification
Non-biting Midge (*Chironomus riparius*)	Technical acetamiprid	0.021	Very highly toxic	45916201	Supplemental
	IM-1-5 (98.9%)	68	Slightly toxic	46255610	Acceptable
Mysid (*Americamysis bahia*)	Technical acetamiprid	0.066	Very highly toxic	44651869	Acceptable
	IM 1-4 (99.6%)	19	Slightly toxic	44651870	Acceptable

Species	Test Substance	48-hr LC_{50} (mg a.i./L)	Toxicity Category	MRID	Study Classification
Water flea *(Daphnia magna)*	Technical acetamiprid	50	Slightly	44651866	Acceptable
	IC-0 (99.7%)	>95.1	Practically non-toxic	44988409	Acceptable
	IM-1-2 (99.6%)	>99.8	Practically non-toxic	44651867	Acceptable
	IM 1-4 (98.7%)	43.9	Slightly toxic	44651868	Acceptable

3.4.B. Terrestrial Organisms

A summary of the most sensitive terrestrial animal toxicity data for acetamiprid, based on a current review of all submitted data, is provided in **Table 25**.

Available data suggest that acetamiprid is very highly toxic to passerine bird species based on an acute oral toxicity study with zebra finch (*T, guttata*), and moderately toxic to other avian species based on an acute oral toxicity test with mallard duck (*A. platyrhynchos*). In the zebra finch study (MRID 48407701), there was 80 and 100% mortality, respectively, at 7 and 10 mg a.i./kg-bw doses, resulting in a 14-day acute oral LD_{50}: 5.68 mg a.i./kg-bw. In the study with mallard duck (MRID 44651859), there was 80 and 100% mortality, respectively, at 124 and 181 mg a.i./kg-bw doses, resulting in a 14-day acute oral LD_{50}: 84.4 mg a.i./kg-bw. In a sub-acute dietary toxicity test with zebra finch (MRID 48844901), there was 70, 80 and 100% mortality, respectively, at the 60, 90 and 120 mg a.i./kg-bw doses, resulting in a sub-acute dietary LD_{50}: 58.2 mg a.i./kg-diet. In a sub-acute dietary toxicity test with mallard duck (MRID 44651861), mortality did not exceed 40% at the highest tested dose, resulting in a sub-acute dietary LD_{50}: ≥5000 mg a.i./kg-diet.

Although zebra finches are the most sensitive bird tested with acetamiprid on both an acute oral and subacute dietary exposure basis, no chronic toxicity data are available for this species. In a one-generation toxicity study with *A. platyrhynchos* (MRID 49342202), no treatment-related mortality was reported at any treatment level. However, overall weight gain was significantly ($p<0.05$) reduced by 50% in female birds at the highest treatment level (402 mg a.i./kg-diet). There were also significant ($p<0.05$) decreases relative to the control at 402 mg a.i./kg-diet in: number of eggs laid (51% decrease); number of eggs set (48% decrease); number of viable embryos (51% decrease); number of living 3-week old embryos (54% decrease); number of hatched eggs per hen (49% decrease); and, number of surviving hatchlings (49% decrease). While there was a significant ($p<0.05$) reduction (*i.e.*, 1.2%) in the number of un-cracked eggs per eggs laid at 99 mg a.i./kg diet along with a 7.5% decrease in food consumption, this adverse effect was determined to not be biologically meaningful. Based on the range and severity of effects at the highest treatment level, the NOAEC for this study was considered to be 99 mg a.i./kg-diet, and the LOAEC was considered to be 402 mg a.i./kg-diet.

Available data suggest that acetamiprid is highly toxic to mammals based on an acute toxicity study with laboratory rats (*Rattus rattus*, MRID 44651833). In the 14-day study, male rats were provided acetamiprid at 100, 150, 230, 340 and 510 mg a.i./kg bw, and female rats at 80, 100, 120, 140 and 160 mg a.i./kg-bw. The resulting 14-day LD_{50} values were 217 mg a.i./kg bw for male rats, and 149 mg a.i./kg-bw for female rats; in addition, the following sublethal behavioral effects were observed in the highest three test doses (for both sexes): crouching immediately (1-3 hrs) after dose administration; and, tremors following (3-34 hrs) dose administration. In a two-year toxicity (and oncogenicity) study (MRID 44988429) with *R. rattus*, test animals were provided acetamiprid at 160, 400 and 1000 mg a.i./kg-diet, and then monitored periodically for 24 months. In male rats there was a 13.3% reduction ($p<0.05$) in mean body weight at 1000 mg a.i./kg-diet, and in female rats there were 10.4 and 15.2% reductions, respectively, at 400 and 1000 mg a.i./kg-diet. Mean body weight gains for male (at 1000 mg a.i./kg-diet) and female (at 400 and 1000 mg a.i./kg-diet) rats were also reduced 10% ($p<0.05$) for all study intervals. Additionally, the following clinical observations of abnormal behaviors were made: males – rales, hunched posture, labored breathing, red/brown material around the nose; females - hunched posture and labored breathing. Based on adverse effects at the two highest treatment levels, the NOAEC for this study was considered to be 160 mg a.i./kg-diet. In addition to growth endpoints, reproductive effects were also observed at 280 mg ai/kg-diet in a two-generation study (MRID 44988430). The NOAEC (160 mg ai/kg diet) that will be used for the risk assessment is based on the growth endpoints from the 2-year chronic feeding study (MRID 44988429).

Table 25. Most Sensitive Terrestrial Animal Toxicity Endpoints for Acetamiprid

Species	Measured effect	Test Duration (Exposure Duration)	Endpoint	Test Substance (% a.i.)	MRID (Study Classification)
Birds – Acute Oral					
Taeniopygia guttata (Zebra finch)	Mortality	14 days (single dose)	LD_{50}: 5.68 mg a.i./kg-bw (Very highly toxic)	99.9%	48407701 (Acceptable)
Anas platyrhynchos (Mallard duck)	Mortality	14 days (single dose)	LD_{50}: 84.4 mg a.i./kg-bw (Moderately toxic)	99.9%	44651859 (Acceptable)
Birds – Sub-Acute Dietary					
Taeniopygia guttata (Zebra finch)	Mortality	8 days (5 days)	LD_{50}: 58.2 mg a.i./kg-diet	>99.9%	48844901 (Acceptable)
Anas platyrhynchos (Mallard duck)	Mortality	8 days (5 days)	LD_{50}: >5000 mg a.i./kg-diet	99.9%	44651861 (Supplemental)
Birds – Chronic					
Anas platyrhynchos (Mallard duck)	Food consumption (7.5% decrease), 1.2% decrease in ratio of eggs not cracked to eggs laid	22 weeks	NOAEC: 99 mg a.i./kg-diet LOAEC: 402 mg a.i./kg-diet	97.8%	49342202 (Acceptable)
Mammals					
Rattus norvegicus (laboratory rat)	Mortality	14 days (single dose)	LD_{50}: 146 mg a.i./kg-bw; females (Highly toxic)	99.5%	44651833 (Acceptable: Reviewed by HED)
	Growth (female body weight; female weight gain)	24 months	NOAEC: 160 mg a.i./kg-diet LOAEC: 400 mg a.i./kg-diet	Not stated in DER	44988429

3.4.B.i. Terrestrial Invertebrates

The tiered process and underlying data used by EFED to assess potential risk to bees is outlined in the 2014 Guidance for Assessing Pesticide Risks to Bees (USEPA *et al.*, 2014). In 2011, EPA evaluated the available data on honey bees (*Apis mellifera*) and noted uncertainty regarding the laboratory-based acute contact and oral toxicity data on both individual honey bees and non-*Apis* bees (*i.e.*, bumble bee *Bombus terrestris*) (USEPA, 2011, DP389536+). At that time, no laboratory-based chronic toxicity data were available on individual bees; however, two semi-field colony-level studies were available in which no statistically significant effects were observed on the bees following foliar applications of acetamiprid at rates equivalent to 0.09 and 0.15 lbs ai/A. The preliminary problem formulation written in support of the Registration Review of acetamiprid (USEPA, 2012, DP401171) reiterated the uncertainties with respect to the laboratory-based studies on individual adult and larval bees as well as data provided through a toxicity of residues on foliage study with acetamiprid.

Table 26 summarizes the available toxicity data for acetamiprid on bees along with the respective tier of the risk assessment process with which these data are associated. More detailed information on each of these studies is provided in **Appendix B**. Based on best available information, the adult bee acute contact and oral LD_{50} values for acetamiprid are 10.53 and 8.96 µg ai/bee (MRID 50015704), respectively. Although these studies were conducted with a formulated product (EXP 60707™ A; 20% acetamiprid) not currently registered in the U.S., the results are relatively consistent with registrant-submitted data on the technical grade active ingredient (TGAI) indicating acute contact and oral toxicity values of <12.4 and >10.21 µg ai/bee (MRID 44651874), respectively. Therefore, acetamiprid is classified as moderately toxic to bees on an acute exposure basis.

Chronic (repeat dose) toxicity testing with adult bees using TGAI resulted in a 10-day NOAEL of 2.42 µg ai/bee where there was a 20% increase in mortality at the LOAEL of 7.41 µg ai/bee (MRID 50015702).

No acute (single dose) toxicity data are available for honey bee larvae; however, chronic (repeat dose) toxicity data are available for larvae using TGAI resulting in a 7-day NOAEL of 12.2 µg ai/bee where there was 37.5% mortality at the LOAEL of 26.4 µg ai/bee (MRID 50015703). In the absence of acute (single dose) toxicity data, the LD_{50} (21.73 µg ai/bee) based on larval mortality from the 7-day repeat dose study can be used as a substitute for the acute larval endpoint. While the chronic toxicity study provides useful data on the potential toxicity of acetamiprid to developing larvae, it is not consistent with the more recent OCED Guidance Document 239 (OECD, 2016) that extends such tests through adult emergence. While there is uncertainty as to how acetamiprid may affect pupal development or adult emergence; the 7-day larval chronic (repeat dose) toxicity data represents the best available data at this time for possible acetamiprid effects on larval bees.

Table 26. Summary of Laboratory-based (Tier 1) and Colony-level Semi-field (Tier 2) and Full-field (Tier 2) Acetamiprid Studies

Study Tier	Guideline	Toxicity Endpoint (µg ai/bee)	Toxicity Category	MRID	Study Classification
1	850.3020	LD_{50} <12.5	Moderately toxic	44651874	Supplemental
		LD_{50} = 10.53	Moderately toxic	50015704	Supplemental
		LD_{50} >100	Practically nontoxic	45932503	Supplemental
		LD_{50} >10.21	Slightly-toxic	44651874	Supplemental

Study Tier	Guideline	Toxicity Endpoint (μg ai/bee)	Toxicity Category	MRID	Study Classification
	Non-Guideline (OECD TG 213)	LD_{50} = 8.96	Moderately toxic	50015704	Supplemental
		LD_{50} = 22.32	Practically nontoxic	45932503	Supplemental
	Non-Guideline (OECD Draft TG)	10-day NOAEL=2.42	NA	50015702	Supplemental
	Non-Guideline (OECD Draft TG)	7-day NOAEL 12.20 LOAEL 26.4 (mortality)	NA	50015703	Supplemental
-	850.3030	*Inconclusive results*		44651875	Invalid
		RT_{25}<3 hrs		45346901	Acceptable
2 (&3)	Non-Guideline (OECD Guidance 75)	Foliage (0.011 – 0.013 ppm @ 20 DAA) Pollen (0.157 – 0.178 ppm @ 3 DAA; 0.104 – 0.136 ppm @ 6 DAA) Nectar (0.068 – 0.128 ppm @ 3 DQAA; <LOQ of 0.01 – 0.012 ppm @ 6 DAA)		50015701	Supplemental
3	850.3040	*No significant effects (see* ***Appendix B*** *for more details).*		45932504	Supplemental
				45932505	Supplemental

Toxicity data are also available for the social non-*Apis* bumble bee (*B. terrestris*) with acute contact and oral LD_{50} values of >100 and 22.3 μg ai/bee (MRID 45932503), respectively. These studies were conducted using the formulation EXP™ 60707 A; therefore, the same uncertainty exists on how the toxicity may compare to the TGAI. However, since both of these toxicity estimates are >11 μg ai/bee, acetamiprid would be classified as practically non-toxic to bumble bees on an acute exposure basis. Based on acute toxicity values for both bumble bees and honey bees, the toxicity endpoints for honey bees appear to be protective (*i.e.*, more sensitive) for non-*Apis* bees.

Tier II colony-level studies have been submitted for acetamiprid. In a supplemental tunnel study with phacelia (*Phacelia tanacetifolia*), two foliar applications of formulated acetamiprid (Mospilan™ 20 SG; 20.4% ai) were made, each at a rate of 0.089 lbs ai/A with an 8-day reapplication interval (MRID 49342201). The second application was made while bees were actively foraging at full bloom; the treatments did not result in any statistically significant effect on overall colony performance. Acetamiprid residues were brought back to the study colonies in both nectar and pollen and residues were detected in comb pollen and nectar as well, demonstrating that the bees were exposed. Although the study authors reported statistically significant ($p<0.05$) reductions in the number of foraging bees following the second application of acetamiprid (18.9 ± 0.05 bees/colony/m^2) relative to controls (21.0 ± 1.2 bees/colony/m^2), the effect appears to have been transitory and was not accompanied by any other significant effect on endpoints measured in the study. Colonies were not monitored beyond 21 days after the exposure phase of the study; therefore, there is uncertainty regarding any potential long-term effects on overwintering. Statistically significant ($p<0.05$) effects on adult and larval bees measured in reference toxicant (fenoxycarb)-treated colonies demonstrated that the study design was sufficient to detect treatment effects on developing brood.

As noted in earlier assessments (USEPA, 2012, DP401171), two semi-field studies conducted to evaluate the possible effect of acetamiprid on honey bee behavior were also submitted (MRIDs 45932504;

45932505), and were classified as supplemental. Both studies used tunnels to expose honey bees via contact with forage and/or overspray, and applications rates were equivalent to 0.15 and 0.09 lbs ai/ A, which are in line with single application rates for many registered crop uses. Mortality, flight frequency, and foraging behavior were evaluated relative to a control and a known toxic standard. No significant effects on any endpoints were observed in either study from acetamiprid treatments.

In a supplemental full-field pollinator study (MRID 50091901), the formulated end-use product Acetamiprid™ 20 SG (20.44% active ingredient; a.i.) was applied to *P. tanacetifolia* in full bloom either after honey bee foraging activities (treatments T2 and T3), or during honey bee foraging activity (treatment T1). Acetamiprid treatments were made at a rate of 0.089 lbs a.i./A; T1 & T2, or at 75 g a.i./ha (0.067 lbs a.i./A; T3); the control (C) field was untreated. Each treatment consisted of a single replicate. In general, bee mortality across all colonies was higher in the colonies leading up to the exposure phase of the study than post-exposure. The overall number of adult bees increased in control and acetamiprid-treated colonies through the exposure phase of the study, then declined in the control colony and acetamiprid-treated colonies in T2 and T3 fields; colony strength in the T1 field continued to increase until 28DAA2, then declined. Total brood (eggs, larvae and pupae) increased across all colonies until 7DAA2, then declined. Since the study was not replicated, it has limited ability to detect treatment effects; however, the study did provide information on acetamiprid residues. Peak residues in pollen were 16.96, 2.05, and 8.60 mg ai/kg on the day of application in treatments T1, T2 and T3, respectively; residues in nectar peaked at 1.17, 5.60, and 1.97 mg/kg in treatments T1, T2 and T3 on the day of application. For both pollen and nectar, residues were below the limit of detection (LOD=0.003 mg/kg) by 14 days after application. Residues measured in bees on the day of application were 0.15, 0.02 and 0.06 mg/kg in T1, T2 and T3, respectively. Residues in pollen and in bees themselves were higher in T1 where applications were made while bees were actively foraging. While residues levels are reported in the study, the study did not provide sufficient data to estimate the amount of variability that was associated with these estimates.

A second semi-field study (MRID 50015701) that is classified as supplemental evaluated residue levels of acetamiprid in honey bee-collected pollen (from pollen baskets; corbicula) and nectar (from honey stomach), and comb honey from oil-seed rape (canola; *Brassica napus*) from foliar treatments at full bloom with formulated acetamiprid (Acetamiprid™ 20 SG; 19.9% a.i.) at a rate of 250 g product/ha (0.22 lbs product/A) representing 50 g a.i./ha (0.045 lbs a.i./A) while bees were actively foraging. Colonies (20 frame) were placed in 100 m^2 tunnels enclosing oil-seed rape; residues in nectar and pollen collected by forager bees were sampled at 3 and 6 days after application (DAA), while residues in oilseed rape plants (composites of lower, middle were upper portions of the plant) collected at -1 and 20DAA; and, residues in comb honey were sampled at 20DAA. Residues in acetamiprid-treated plants sampled at 20DAA ranged from 0.011 to 0.013 mg ai/kg. Residues in bee-collected pollen ranged from 0.157 – 0.178 mg a.i./kg at 3DAA and ranged from 0.104 – 0.136 mg a.i./kg at 6 DAA. Residues in nectar from honey stomachs of forager bees ranged from 0.068 to 0.128 mg a.i./kg at 3DAA and ranged from <LOQ (0.01 mg a.i./kg) to 0.012 mg a.i./kg at 6DAA. Residues in comb honey at 20DAA were <LOQ. Under the conditions tested, maximum residues detected in pollen and nectar 3DAA were 0.178 and 0.128 mg/kg, respectively. By 6DAA, residues in pollen and nectar were 0.136 and 0.012 mg/kg, respectively. In comb honey by 20DAA, residues in two of the replicates were <LOD while one was <LOQ. The maximum residue in plants at 20DAA was 0.013 mg/kg. There is uncertainty however regarding the extent to which the formulation of acetamiprid used in the study is representative of products registered in the U.S. and their maximum application rates. Also, rain events during the study may have affected exposure, *i.e.*, the extent to which bees may have been foraging as well as the extent to which acetamiprid was available for uptake/distribution by the plants.

Although laboratory-based acute larval toxicity data are not available for acetamiprid and the current laboratory-based chronic larval toxicity study did not extend beyond the larval stage of development, semi-field studies do not suggest acute adverse effect on brood. Brood termination rate in the semi-field study for both acetamiprid and control colonies was relatively high (~36%); however, this may be due to the fact the study was conducted in August and colonies were subject to limited availability of pollen/nectar.

Since acetamiprid is classified as moderately toxic (*i.e.*, $2<LD_{50}<11$ μg ai/bee) to honey bees on an acute contact exposure basis and the compound has registered uses where bees may be exposed, toxicity of residues on foliage data (USEPA, 2012c) are required (40 CFR Part 158.630). While other studies (MRID 44651875) on the toxicity of residues on foliage have been previously reviewed (USEPA, 2012, DP401171, 2015, DP426111+) and determined to be inadequate, a study (MRID 45346901) honey bees showed no treatment-related mortality when exposed for 24 hours to alfalfa foliage collected at 3, 8 and 24 hours after application of formulated acetamiprid (NI-25™; 73.89% active ingredient) by itself and NI-25™ combined with formulated triflumizole (Procure® 50 WS; 50% active ingredient) at a nominal application rate of 0.15 lbs ai/A for NI-25 by itself and 0.5 lbs/A for the combination of NI-25 with Procure® (where again, the amount of acetamiprid was a rate of 0.5 lbs ai/A). Based on an absence of statistically significant mortality at the application rates tested for both formulated acetamiprid alone or when in combination with Procure®, the residual time needed to reduce the activity of acetamiprid and bring mortality down to 25%, *i.e.*, the RT_{25}, is less than 3 hrs.

Of the 94 incidents associated with acetamiprid, 34 involved the loss of honey bees. The reported number of colonies affected ranged from 9 – 12,000. The one incident involving up to 12,000 colonies occurred in Ontario, Canada. The majority (76%) of incidents involving bees occurred in Ontario, Canada, followed by 12% in California, 6% in Indiana, and 3% each in Arizona and Oregon. The majority (79%) of incidents occurred in 2012, while 9% occurred in 2015 with 3% each were reported in 2004, 2011, 2014, and 2016. Of all the incidents involving bees, the majority (68%) had a certainty of "possible", 18% "probable", and 12% "unlikely", while only one had a certainty classification as "highly probable"; however, this incident which was associated with the use of acetamiprid on cotton in California in 2011 was considered to be the result of misuse. Of the remaining incidents, the majority (85%) had a legality classification of "undetermined". Only a single incident in 2016 which took place in Oregon and was associated with a residential use, was classified as a "registered" use.

As discussed in previous assessments (USEPA, 2009, DP364328), research by Iwasa *et al.* (2004) indicates that relative to other neonicotinoid insecticides, honey bees were less sensitive to acetamiprid. According to the study authors, nitro-substituted neonicotinoids insecticides like imidacloprid, clothianidin, dinotefuran and thiamethoxam, were the most toxic to bees while the cyano-substituted neonicotinoids such as acetamiprid and thiacloprid exhibited a much lower toxicity to honey bees. However, when bees were treated with a combination of acetamiprid and piperonyl butoxide (an inhibitor of cytochrome P450 enzymes), the toxicity of acetamiprid was increased by at least a factor of 6X. This study also reported that the acetamiprid metabolites N-dimethyl acetamiprid, 6-chloro-3-pyridylmethanol and *o*-chloro-nicotinic acid when applied topically, produced no mortality at 50 μg/bee and as such would be classified as practically non-toxic to bees on an acute contact exposure basis. The authors concluded that cytochrome P450 enzymes are an important mechanism for acetamiprid detoxification and their relatively low toxicity to honey bees.

3.4.B.ii. Terrestrial Plants

A single study (MRID 44988413) is available containing Tier I seedling emergence and vegetative vigor data for several monocots (including: corn [*Zea mays*], oat [*Avena sativa*], onion [*Allium cepa*], perennial ryegrass [*Lolium perenne*]) and dicots (including: cabbage [*Brassica oleracea*], cucumber [*Cucumis sativus*], lettuce [*Lactuca sativa*], soybean [*Glycine max*], tomato [*Lycopersicon esculentum*], and turnip [*Brassica rapa*]). In the seedling emergence test, emergence was not affected in all species at any acetamiprid dose (**Table 27**). There were, however, reductions in shoot length of cucumber, onion, and tomato exposed at 0.15, 0.32 and 0.62 lbs a.i./A. Based on these data, the most sensitive monocot species was onion with an EC_{25} of 0.23 lbs a.i./A, and the most sensitive dicot species was cucumber, with an EC_{25} of 0.16 lbs a.i./A (**Table 27**). The NOAEC (based on shoot length reductions) in cucumber (dicot) and onion (monocot) was 0.077 lbs ai/A. In the vegetative vigor test, shoot length in all species was unaffected by all acetamiprid treatments, and plant weight was also unaffected in cabbage, corn, cucumber, oat, onion, soybean and tomato. There was, however, a reduction in the mean weight for lettuce, perennial ryegrass, and turnip exposed to various concentrations of acetamiprid. The most sensitive monocot species in the vegetative vigor test was perennial ryegrass, with an EC_{25} of 0.46 lbs a.i./A and a NOAEC of 0.31 lbs a.i./A. The most sensitive dicot species was lettuce, with a EC_{25} of 0.016 lbs a.i./A and a NOAEC of 0.0094 lbs a.i./A.

A subsequent study was submitted concerning the effect of acetamiprid on vegetative vigor on lettuce alone (MRID 45921401). In this study, the EC_{25} and NOAEC for plant weight were determined to be 0.012 and <0.0025 lbs a.i./A, respectively. Shoot length was the more sensitive parameter with an EC_{25} of 0.0056 and a NOAEC of 0.0025 lbs a.i./A.

Table 27. Most Sensitive Terrestrial Plant Endpoints for Acetamiprid

Plant Species	Test Substance (% a.i.)	EC_{25} (lbs a.i./A)	NOAEC (lbs a.i./A)	Endpoints Affected	MRID (Classification)
Seedling Emergence					
Onion (monocot)	71.1	0.23	0.077	Shoot length	44988413 (Supplemental)
Cucumber (dicot)		0.16	0.077		
Vegetative Vigor					
Perennial ryegrass (monocot)	71.1	0.46	0.31	Plant weight	44988413 (Acceptable)
Lettuce (dicot)	70.04	0.0056	0.0025	Shoot length	45921401 (Supplemental)

4. Risk Characterization

This assessment relies on the deterministic RQ method to provide a metric of potential risks. The RQ provides a comparison of exposure estimates to toxicity endpoints (*i.e.*, estimated exposures divided by acute and/or chronic toxicity endpoints expressed in the same units as exposures, respectively). The resulting unitless RQ values, calculated in the Risk Estimation Section) are compared to the Agency's LOCs. The LOCs are used by the Agency to indicate when the use of a pesticide, as directed by the label, has the potential to result in exposure levels sufficient to cause adverse effects to non-target organisms. For endangered species, LOC exceedances require an additional in-depth listed species evaluation to characterize risks for the potential co-occurrence of listed species and areas in which crops are grown. In this approach, RQs that exceed the risk to non-listed species LOCs necessarily also exceed the corresponding risk to listed species LOCs. Acute risk LOCs are different for listed and non-listed taxa; however, the chronic risk LOC is 1.0 across all animals. For plants, unlike for animals, RQ values are not presented for acute versus chronic risk; instead, RQ values are presented for listed and non-listed species based on a comparison of a given EEC to NOAEL and EC_{25} values (for terrestrial plants) and EC_{50} values (for aquatic plants), respectively. The LOC for all plants is 1.0. A discussion of the RQ values for acetamiprid and of other information that provides context for the interpretation of potential risk to various taxa is presented in the Risk Description in **Section 4.2**.

RQs were calculated for use patterns that were considered to have a complete potential exposure pathway and for selected use patterns that had the highest amounts of acetamiprid applied, a unique exposure pathway, or would support bracketing potential exposure.

4.1. Risk Estimation

4.1.A. RQ Values for Aquatic Organisms

The PWC was used to calculate water-column and sediment pore water 1-in-10-year daily average, 21-day average, and 60-day average EECs for aquatic organisms based on ROCs (acetamiprid + IM 1-4) (**Table 15**). Toxicity endpoints used to calculate RQs are the most sensitive acute and chronic endpoints for each taxon described previously (with the exception of the chronic chironomid endpoint), and are also specified in **Table 28**, which gives the RQ values resulting from these calculations. The chronic chironomid endpoint was derived using an ACR (26.4) based on the acute and chronic toxicity data for mysid shrimp (*A. bahia*). Acute RQ values are generated by comparing the most sensitive toxicity endpoint to the 1-in-10 year daily average for both aquatic vertebrates and invertebrates. Chronic RQ values for aquatic vertebrates are derived by comparing the chronic NOAEC to the 60-day average exposure values, while chronic RQ values for aquatic invertebrates are derived by comparing the respective NOAEC to the 21-day average exposure values.

EECs based on parent acetamiprid alone are available in **Appendix I**, and RQs based on parent acetamiprid alone are presented and discussed in **Section 4.2.A**.

The seed treatment and residential use patterns do not result in LOC exceedances for aquatic organisms, and so are not included in the summary provided in **Table 28**. There are RQ exceedances for aquatic invertebrates as a result of agricultural uses in which acetamiprid is applied as a foliar spray. RQ values for all of the foliar agricultural use patterns exceed acute risk LOCs for listed (0.05) and non-listed (0.5 freshwater and estuarine/marine invertebrates, as well as chronic risk LOCs (1.0) for freshwater and estuarine/marine invertebrates (**Table 28**).

Table 28. Risk Quotients (RQs) for Direct Effects to Aquatic Invertebrates Inhabiting the Water-column from Agricultural Foliar Applications (on the Basis of Total ROCs [*i.e.*, acetamiprid + I-M 1-4])

Use Scenario	EECs (1-d/21-d/60-d, µg a.i./L)	Freshwater Invertebrates		Estuarine/Marine Invertebrates	
		Acute Chironomid EC_{50} = 21 µg a.i./L	**Chronic** Chironomis NOAEC = 0.8 µg a.i./L[1]	**Acute** Mysid EC_{50} = 66 µg a.i./L	**Chronic** Mysid NOAEC = 2.5 µg a.i./L
Citrus	24.9/24.2/23.1	**1.19**	**30.25**	**0.38**	**9.68**

Use Scenario	EECs (1-d/21-d/60-d, μg a.i./L)	Freshwater Invertebrates		Estuarine/Marine Invertebrates	
		Acute Chironomid EC_{50} = 21 μg a.i./L	**Chronic** Chironomis NOAEC = 0.8 μg a.i./L[1]	**Acute** Mysid EC_{50} = 66 μg a.i./L	**Chronic** Mysid NOAEC = 2.5 μg a.i./L
Cotton	27.5/27.1/26.4	**1.32**	**33.88**	0.42	**10.84**
Cranberry (PFAM)[4]	37.3/36.4/34.0	**1.78**	**45.50**	**0.57**	**14.56**
Fruiting Vegetables	23.4/24.0/21.7	**1.12**	**30.00**	0.35	**9.60**
Leafy Vegetables	18.5/18.2/17.8	**0.89**	**22.75**	0.28	**7.28**
Low-growing Berries (1 CC)[3]	10.8/10.5/10.0	**0.52**	**13.13**	0.16	**4.20**
Low-growing Berries (3 CC)[3]	32.6/31.6/30.4	**1.56**	**39.50**	0.49	**12.64**
Ornamentals Grown in Fields/ Plantations	28.4/27.5/25.7	**1.36**	**34.38**	0.43	**11.00**
Pome Fruit	24.0/23.3/22.2	**1.15**	**29.13**	0.36	**9.32**
Tree Nuts	22.3/21.6/20.9	**1.07**	**27.00**	0.35	**9.60**

A **bold** value indicates that the RQ meets or exceeds the acute listed (0.05) and non-listed (0.5) LOC, or the chronic risk LOC (1.0). An asterisk ("*") on an acute value indicates that only the acute listed species LOC (0.05) is exceeded.
[1] The NOAEC used to estimate risk quotients for freshwater invertebrates was calculated using an ACR of 26.4 based on acute and chronic data for mysid (*A. bahia*).
[2] Toxicity endpoints are based on water-column toxicity studies because sediment pore water toxicity endpoints are not available.
[3] The labels allow for use on crop group 13-07 G low growing berries (including cranberries). This RQ would be representative for uses on cranberries and other low growing berries that are not intermittently flooded.
[4] Pore-water EECs were not calculated for use on cranberries. However, the EECs for the cranberry use pattern are expected to be similar to those captured in this table for other use patterns.

Aquatic vertebrate toxicity endpoints range from 19,200 μg a.i./L to >100,000 μg a.i./L, and the maximum estimated water EECs are <10.8 to 37.3 μg a.i./L. Acute and chronic RQ values for both freshwater fish (which serve as a surrogate for aquatic-phase amphibians) and estuarine/marine fish are all below 0.01, and are therefore below LOCs for both acute risk to listed (0.05) and non-listed (0.1) species, as well as for chronic risk (1.0). RQ values based on chronic exposure to estuarine/marine fish are not calculated because chronic toxicity data are not available for estuarine/marine fish, and it was not possible to calculate an ACR to estimate a chronic endpoint. Given that RQs based on available data for aquatic vertebrates are all <0.01, additional data are not needed for estuarine/marine fish at this time. The likelihood of adverse effects to aquatic vertebrates from the evaluated use patterns is considered to be low.

No-observed-effect values for vascular and non-vascular aquatic plants range from 1,000 to 1,100 μg a.i./L and EC_{50} values are greater than 1,000 to 1,100 μg a.i./L. Since the highest daily average EEC for any existing uses of acetamiprid is 53.1 μg a.i./L (**Table 15**), aquatic plant RQs are less than 0.06, and therefore below the LOC of 1. The likelihood of adverse effects to aquatic plants from the evaluated use patterns is considered to be low.

4.1.B. RQ Values for Terrestrial Organisms

Exposure estimates for birds and mammals were calculated using upper-bound Kenaga values calculated using T-Rex version 1.5.2 (**Table 19**). As noted previously, birds serve as a surrogate species for reptiles and terrestrial-phase amphibians. Toxicity endpoints used to calculate RQs are the most sensitive for the taxa evaluated and are described in the tables showing the RQ values.

The acute dose-based RQ values, based on toxicity to zebra finch, exceed the LOC for acute risk to listed (RQ≥0.1) and non-listed (RQ≥0.5) species for all size classes under all of the evaluated use scenarios for all forage items except for fruits/pods and seeds (**Table 29**). Under the citrus, ornamental, pome fruit and tree nut use scenarios there are also exceedances of the LOC for acute risk to listed (RQ≥0.1) and non-listed (RQ≥0.5) birds for small- and medium-sized animals. Additionally, sub-acute dietary-based RQ values, based again on toxicity to zebra finch, exceed the LOC for acute risk to listed (RQ≥0.1) and/or non-listed (RQ≥0.5) birds for all forage items except for fruits/pods across all use scenarios except for the two low-growing berry scenarios. There are exceedances of the chronic risk LOC (RQ≥1) for short grass consumption under the citrus, ornamental, pome fruit and tree nut use scenarios on the basis of the measured mallard duck NOAEC. However, chronic RQs likely underestimate the potential for risk for passerines, as chronic toxicity data are not available for passerines, which are an order of magnitude more sensitive on an acute oral exposure basis, and two orders of magnitude more sensitive on a sub-acute dietary exposure basis than mallard ducks.

Table 29. Acute and Chronic Risk Quotients (RQs; Upper-Bound Kenaga Values) For Birds Based on the Evaluated Acetamiprid Uses and Using the 35-day Foliar Dissipation Half-life.

Food Type	Acute Dose-Based RQs[1] *Zebra finch (LD_{50} = 5.68 mg/kg bw)*			Subacute Dietary RQs[2] *Zebra finch (LC_{50} = 58.2 mg/kg diet)*	Chronic Dietary-Based RQs *Mallard duck*[3]
	Small (20 g)	Medium (100 g)	Large (1000 g)		
Citrus: 2x 0.249 lbs a.i./A, 1x 0.052 lbs a.i./A, 7-day interval					
Short grass	**21.06**	**9.43**	**2.99**	**1.92**	**1.13**
Tall grass	**9.65**	**4.32**	**1.37**	**0.88**	0.52
Broadleaf plants/small insects	**11.85**	**5.31**	**1.68**	**1.08**	0.64
Fruits/pods/(seeds, dietary only)	**1.32**	**0.59**	0.19*	0.12	0.07
Arthropods	**8.25**	**3.69**	**1.17**	**0.75**	0.44
Seeds (granivore)	0.29*	0.13*	0.04	NA	
Cotton: 4x 0.101 lbs a.i./A, 7-day interval					
Short grass	**15.02**	**6.73**	**2.13**	**1.37**	0.81
Tall grass	**6.88**	**3.08**	**0.98**	**0.63**	0.37
Broadleaf plants/small insects	**8.45**	**3.78**	**1.20**	**0.77**	0.45
Fruits/pods/(seeds, dietary only)	**0.94**	0.42*	0.13*	0.09	0.05
Arthropods	**5.88**	**2.63**	**0.83**	**0.54**	0.32
Seeds (granivore)	0.21*	0.09	0.03	NA	
Leafy & Fruiting Vegetables: 1x 0.15 lbs a.i./A, 3x 0.075 lbs a.i./A, 7 day interval					
Short grass	**13.39**	**6.00**	**1.90**	**1.22**	0.72
Tall grass	**6.14**	**2.75**	**0.87**	**0.56**	0.33
Broadleaf plants/small insects	**7.53**	**3.37**	**1.07**	**0.69**	0.40

Food Type	Acute Dose-Based RQs[1] *Zebra finch (LD_{50} = 5.68 mg/kg bw)* Small (20 g)	Medium (100 g)	Large (1000 g)	Subacute Dietary RQs[2] *Zebra finch (LC_{50} = 58.2 mg/kg diet)*	Chronic Dietary-Based RQs *Mallard duck[3]*
Fruits/pods/(seeds, dietary only)	**0.84**	0.37*	0.12*	0.08	0.04
Arthropods	**5.24**	**2.35**	**0.74**	0.48*	0.28
Seeds (granivore)	0.19*	0.08	0.03	NA	
Low Growing Berries & Cranberries: 2x 0.131 lbs a.i./A, 7 day interval					
Short grass	**11.08**	**4.96**	**1.57**	**1.01**	0.59
Tall grass	**5.08**	**2.27**	**0.72**	0.46*	0.27
Broadleaf plants/small insects	**6.23**	**2.79**	**0.88**	**0.57**	0.33
Fruits/pods/(seeds, dietary only)	**0.69**	0.31*	0.10	0.06	0.04
Arthropods	**4.34**	**1.94**	**0.62**	0.40*	0.23
Seeds (granivore)	0.15*	0.07	0.02	NA	
Low Growing Berries (3 crop cycles): Per CC - 2x 0.132 lbs a.i./A, 1x 0.032 lbs a.i./A, 7 day interval					
Short grass	**13.49**	**6.04**	**1.91**	**1.23**	0.72
Tall grass	**6.18**	**2.77**	**0.88**	**0.56**	0.33
Broadleaf plants/small insects	**7.59**	**3.40**	**1.08**	**0.69**	0.41
Fruits/pods/(seeds, dietary only)	**0.84**	0.38*	0.12*	0.08	0.05
Arthropods	**5.28**	**2.37**	**0.75**	0.48*	0.28
Seeds (granivore)	0.19*	0.08	0.03	NA	
Ornamentals: 1x 0.52 lbs a.i./A, 1x 0.03 lbs a.i./A, 7 day interval					
Short grass	**23.51**	**10.53**	**3.34**	**2.14**	**1.26**
Tall grass	**10.78**	**4.83**	**1.53**	**0.98**	0.58
Broadleaf plants/small insects	**13.23**	**5.92**	**1.88**	**1.21**	0.71
Fruits/pods/(seeds, dietary only)	**1.47**	**0.66**	0.21*	0.13	0.08
Arthropods	**9.21**	**4.12**	**1.31**	**0.84**	0.49
Seeds (granivore)	0.33*	0.15*	0.05	NA	
Pome Fruit: 4x 0.15 lbs a.i./A, 12 day interval					
Short grass	**19.67**	**8.81**	**2.79**	**1.79**	**1.05**
Tall grass	**9.02**	**4.04**	**1.28**	**0.82**	0.48
Broadleaf plants/small insects	**11.06**	**4.96**	**1.57**	**1.01**	0.59
Fruits/pods/(seeds, dietary only)	**1.23**	**0.55**	0.17*	0.11*	0.07
Arthropods	**7.70**	**3.45**	**1.09**	**0.70**	0.41
Seeds (granivore)	0.27*	0.12*	0.04	NA	
Tree Nuts: 4x 0.18 lbs a.i./A, 14 day interval					
Short grass	**22.52**	**10.09**	**3.20**	**2.05**	**1.21**
Tall grass	**10.32**	**4.62**	**1.47**	**0.94**	0.55
Broadleaf plants/small insects	**12.67**	**5.68**	**1.80**	**1.16**	0.68
Fruits/pods/(seeds, dietary only)	**1.41**	**0.63**	0.20*	0.13*	0.08
Arthropods	**8.82**	**3.95**	**1.25**	**0.80**	0.47
Seeds (granivore)	0.31*	0.14*	0.04	NA	

NA=not applicable

Bolded values meet or exceed the LOCs for acute risk to both non-listed (RQ ≥ 0.5) and listed (RQ ≥ 0.1) bird species, or the LOC for chronic risk to bird species (RQ ≥ 1); values with an asterisk ("*") meet or exceed the LOC for acute risk to listed (RQ ≥ 0.1) bird species only.

[1] Acute dose-based RQ values are based on the zebra finch LD_{50} value of 5.68 mg a.i./kg-bw (MRID 48407701).

[2] Acute dietary RQ values are based on the zebra finch 5-day LC_{50} value of 58.2 mg a.i./kg diet (MRID 48844901).

[3] Chronic RQ values are based on the mallard duck NOAEC value of 99 mg a.i./kg diet (MRID 49342202). Also note that at the LOAEC measured adverse effects were >50%.

Seed Treatments

For assessing acute risk related to treated seeds for avian species, a dose-based RQ[19] is calculated, where the exposure metric is an estimated ingested dose (mg a.i./kg-bw) based on the pesticide concentration on the treated seed and the allometric food ingestion rate[20]. An area-based RQ[21], analogous to an LD_{50} ft^{-2} is also calculated based on the mass of active ingredient per unit area (square foot). This method simply compares the amount of pesticide expected to be present in a square foot to the acute LD_{50} and does not include any specific estimation of pesticide ingested doses. Chronic risks are estimated using a "diet based" approach by comparing the concentration of pesticide on the treated seed divided by the chronic diet-based NOAEC. Additionally, an underlying assumption of the model is that for seeds planted at 0-1" deep, at least 5% of seeds will remain on the soil surface (with more seeds presumed available for species seeded more shallowly). For seeds planted >1" deep the assumption is that 1% of seeds would remain available on the soil surface, so even for seed potatoes (which are generally planted roughly 6" deep) the models assumes some potential for exposure by birds and mammals to these treated seeds.

For the canola and mustard use scenarios, the dose-based and area-based RQ values exceed the acute risk LOC for both listed (RQ≥0.1) and non-listed (RQ≥0.5) species for most size classes, with the exception of the area-based RQ for medium and large birds (**Table 30**). For both of these uses the chronic RQ values exceed the chronic risk LOC. For the potato use scenario, the dose-based and area-based RQ values exceed the acute risk LOC for both listed (RQ≥0.1) and non-listed (RQ≥0.5) species for all size classes, except that the dose-based RQ for large birds did not exceed the acute risk LOC for non-listed species. For the seed piece potato use the chronic RQ values did not exceed the chronic risk LOC.

Table 30. Acute Dose-, Area-based, and Chronic Exposure Based Risk Quotients (RQs) for Birds from Exposure to Acetamiprid-Treated Seed

Crop	Exposure	Risk Quotients		
		Small (20g)	Med (100g)	Large (1000g)
Canola	Dose Based	**167.83**	**75.18**	**23.83**
	LD_{50}/ft^2	**2.85**	**0.45**	0.03
	Chronic	**40.49**		
Mustard	Dose Based	**167.83**	**75.18**	**23.83**
	LD_{50}/ft^2	**2.42**	**0.38**	0.03
	Chronic	**40.49**		
Potato	Dose Based	**3.27**	**1.46**	**0.46**
	LD_{50}/ft^2	**46.98**	**7.38**	**0.52**
	Chronic	0.79		

Bolded values meet or exceed the LOC for acute risk to listed (RQ ≥ 0.1) and/or non-listed (RQ ≥ 0.5) birds or chronic risk to birds (RQ ≥ 1).

[19] RQ = [(Seed Application Rate (mg a.i./kg-seed) * daily food intake (g/day) * 0.001 kg/g) / body weight of animal (kg)] / Adjusted (bw) Toxicity Endpoint (LD_{50})

[20] Assumes 100% of the diet is composed of treated seeds and does not presently account for the probability of consuming a treated seed which may be reduced with soil incorporation of seeds.

[21] RQ = [(Application Rate (lbs a.i./A) * 1,000,000 mg/kg) / (43,560 ft2 * 2.2 lb/kg)] / Adjusted LD50)

The acute dose-based RQ values for all sizes of mammals exceed the LOC for acute risk to listed (RQ≥0.1) species foraging on short grass under the citrus, ornamental, pome fruit and tree nut use scenarios (**Table 31**). There are also acute risk LOC exceedances for small- and medium-sized listed species foraging on tall grass, broadleaf plants/small insects, and arthropods for the citrus, ornamental, pome fruit and tree nut use scenarios. There are no RQs exceeding the acute risk LOC for non-listed species (RQ≥0.5) under any use scenario; and, there are no dietary-based RQ exceedances of the chronic risk LOC (RQ≥1) under any use scenario.

Table 31. Acute and Chronic Risk Quotient (RQs; Upper-Bound Kenaga Values) For Mammals Based on the Evaluated Acetamiprid Uses and Using the 35-day Foliar Dissipation Half-life.

Food Type	Acute Dose-Based RQs[1]			Chronic Dietary-Based RQs
	Small (15 g)	Medium (35 g)	Large (1000 g)	
Citrus: 2x 0.249 lbs a.i./A, 1x 0.052 lbs a.i./A, 7-day interval				
Short grass	0.33*	0.28*	0.15*	0.70
Tall grass	0.15*	0.13*	0.07	0.32
Broadleaf plants/small insects	0.19*	0.16*	0.09	0.39
Fruits/pods/(seeds, dietary only)	0.02	0.02	0.01	0.04
Arthropods	0.13*	0.11*	0.06	0.27
Seeds (granivore)	<0.01	<0.01	<0.01	NA
Cotton: 4x 0.101 lbs a.i./A, 7-day interval				
Short grass	0.24*	0.20*	0.11*	0.50
Tall grass	0.11*	0.09	0.05	0.23
Broadleaf plants/small insects	0.13*	0.11*	0.06	0.28
Fruits/pods/(seeds, dietary only)	0.01	0.01	0.01	0.03
Arthropods	0.09	0.08	0.04	0.20
Seeds (granivore)	<0.01	<0.01	<0.01	NA
Leafy & Fruiting Vegetables: 1x 0.15 lbs a.i./A, 3x 0.075 lbs a.i./A, 7 day interval				
Short grass	0.21*	0.18*	0.10*	0.44
Tall grass	0.10*	0.08	0.04	0.20
Broadleaf plants/small insects	0.12*	0.10	0.05	0.25
Fruits/pods/(seeds, dietary only)	0.01	0.01	0.01	0.03
Arthropods	0.08	0.07	0.04	0.17
Seeds (granivore)	<0.01	<0.01	<0.01	NA
Low Growing Berries & Cranberries: 2x 0.131 lbs a.i./A, 7 day interval				
Short grass	0.17*	0.15*	0.08	0.37
Tall grass	0.08	0.07	0.04	0.17
Broadleaf plants/small insects	0.10*	0.08	0.05	0.21
Fruits/pods/(seeds, dietary only)	0.01	0.01	0.01	0.02
Arthropods	0.07	0.06	0.03	0.14
Seeds (granivore)	<0.01	<0.01	<0.01	NA
Low Growing Berries (3 crop cycles): Per CC - 2x 0.132 lbs a.i./A, 1x 0.032 lbs a.i./A, 7 day interval				
Short grass	0.21*	0.18*	0.10*	0.45

Food Type	Acute Dose-Based RQs[1]			Chronic Dietary-Based RQs
	Small (15 g)	Medium (35 g)	Large (1000 g)	
Tall grass	0.10*	0.08	0.04	0.21
Broadleaf plants/small insects	0.12*	0.10*	0.05	0.25
Fruits/pods/(seeds, dietary only)	0.01	0.01	0.01	0.03
Arthropods	0.08	0.07	0.04	0.18
Seeds (granivore)	<0.01	<0.01	<0.01	NA
Ornamentals: 1x 0.52 lbs a.i./A, 1x 0.03 lbs a.i./A, 7 day interval				
Short grass	0.37*	0.32*	0.17*	0.78
Tall grass	0.17*	0.15*	0.08	0.36
Broadleaf plants/small insects	0.21*	0.18*	0.10*	0.44
Fruits/pods/(seeds, dietary only)	0.02	0.02	0.01	0.05
Arthropods	0.15*	0.12*	0.07	0.31
Seeds (granivore)	0.01	<0.01	<0.01	NA
Pome Fruit: 4x 0.15 lbs a.i./A, 12 day interval				
Short grass	0.31*	0.27*	0.14*	0.65
Tall grass	0.14*	0.12*	0.07	0.30
Broadleaf plants/small insects	0.17*	0.15*	0.08	0.37
Fruits/pods/(seeds, dietary only)	0.02	0.02	0.01	0.04
Arthropods	0.12*	0.10*	0.06	0.26
Seeds (granivore)	<0.01	<0.01	<0.01	NA
Tree Nuts: 4x 0.18 lbs a.i./A, 14 day interval				
Short grass	0.36*	0.30*	0.16*	0.75
Tall grass	0.16*	0.14*	0.07	0.34
Broadleaf plants/small insects	0.20*	0.17*	0.09	0.42
Fruits/pods/(seeds, dietary only)	0.02	0.02	0.01	0.05
Arthropods	0.14*	0.12*	0.06	0.29
Seeds (granivore)	<0.01	<0.01	<0.01	NA

NA=not applicable
Values with an asterisk ("*") meet or exceed the LOC for acute risk to listed (RQ $\geq$ 0.1) mammals only.
[1] Acute dose-based RQ values are based on the laboratory rat LD_{50} value of 146 mg a.i./kg-bw (MRID 44651833).
[2] Chronic RQ values are based on the two-generation laboratory rat NOAEC value of 160 mg a.i./kg diet (MRID 44988429).

Acute RQs from seed treatment uses are calculated for mammals in the same manner as birds, but for mammals, chronic RQs are calculated using a "dose-based" approach in which the ingested dose of pesticide is divided by the dose-based NOAEL. For the canola and mustard use scenarios, the dose-based RQ values exceed the acute risk LOC for both listed (RQ≥0.1) and non-listed (RQ≥0.5) species for all size classes of mammals (**Table 32**). For both of these uses the chronic RQ values exceed the chronic risk LOC. For the potato use scenario, area-based RQ values for small- and medium-sized mammals exceed the acute risk LOC for both listed (RQ≥0.1) and non-listed (RQ≥0.5) species. For the potato use the chronic RQ values do not exceed the chronic risk LOC for any size class.

Table 32. Acute Dose-, Area-based, and Chronic Exposure-Based Risk Quotient (RQs) for Mammals From Exposure to Acetamiprid-Treated Seed

Crop	Exposure	Risk Quotients		
		Small (15 g)	Med (35 g)	Large (1000 g)
Canola	Dose Based	**2.65**	**2.26**	**1.21**
	LD_{50}/ft^2	0.07	0.04	<0.01
	Chronic	**48.31**	**41.26**	**22.12**
Mustard	Dose Based	**2.65**	**2.26**	**1.21**
	LD_{50}/ft^2	0.06	0.03	<0.01
	Chronic	**48.31**	**41.26**	**22.12**
Potato	Dose Based	0.05	0.04	0.02
	LD_{50}/ft^2	**1.18**	**0.63**	0.05
	Chronic	0.94	0.80	0.43

Bolded values meet or exceed the LOC for acute risk to listed (RQ $\geq$ 0.1) and/or non-listed (RQ $\geq$ 0.5) birds or chronic risk to birds (RQ $\geq$ 1).

4.1.C. RQ Values for Terrestrial Invertebrates

The EECs for terrestrial invertebrates were calculated using the equations described in **Section 3.3.B**. Acetamiprid is characterized as moderately toxic to honey bees on both an acute contact and oral exposure basis, based on a study (MRID 50015704) that was conducted with TEP (20 % a.i.) acetamiprid. When these toxicity values are used in Bee-REX (**Appendix D**) at the maximum foliar application rate of 0.52 lbs ai/A, the maximum acute dietary RQ value (1.86) for adult bees exceeds the acute risk level of concern of 0.4 (**Table 33**). Based on the adult chronic toxicity endpoint (NOAEL=2.42 µg ai/bee), the maximum chronic RQ is 6.9 and exceeds the chronic risk LOC of 1.0. As noted, the LD_{50} from the chronic (repeat dose) larval toxicity test was used in lieu of acute (single dose) larval toxicity data. Based on these data the resulting maximum RQ (0.33) is below the acute risk LOC of 0.4. Based on the chronic larval toxicity estimate (NOAEL=12.2 µg ai/bee), the resulting maximum RQ (0.58) is below the chronic risk LOC of 1.0 (**Table 34**).

Table 33. Daily Adult Honey Bee (*Apis mellifera*) Consumption of Food, Pesticide Dose and Resulting Dietary-based Acute and Chronic Risk Quotient (RQ) Values from Foliar Applications of Acetamiprid at 0.52 lbs ai/A

Caste of Task in Hive	Average age (Days)	Brood Jelly (mg/day)	Nectar (mg/day)	Pollen (mg/day)	Total dose (µg a.i./bee)	Acute RQ *Oral LD_{50}: 8.96 µg a.i./bee*	Chronic RQ *NOAEL: 2.42 µg a.i./bee*
Worker (cell cleaning and capping	0 – 10	0	60	6.65	3.812	**0.43**	**1.58**
Worker (brood and queen tending, nurse bees)	6 – 17	0	140	9.6	8.557	**0.96**	**3.54**
Worker (comb building, cleaning and food handling)	11 – 18	0	60	1.7	3.529	0.39	**1.46**
Worker (foraging for pollen)	>18	0	43.5	0.041	2.491	0.28	**1.03**

Caste of Task in Hive	Average age (Days)	Brood Jelly (mg/day)	Nectar (mg/day)	Pollen (mg/day)	Total dose (µg a.i./bee)	Acute RQ *Oral LD_{50}: 8.96 µg a.i./bee*	Chronic RQ *NOAEL: 2.42 µg a.i./bee*
Worker (foraging for nectar)	>18	0	292	0.041	16.705	**1.86**	**6.90**
Worker (maintenance of hive in winter	0 – 90	0	29	2	1.773	0.20	0.73
Drone	>10	0	235	0.0002	13.442	**1.50**	**5.55**
Queen (laying 1500 eggs/day)	Entire life stage	525	0	0	0.300	0.03	0.12

Table 34. Daily Larval Honey Bee (*Apis mellifera*) Consumption of Food, Pesticide Dose and Resulting Dietary-based Acute and Chronic Risk Quotient (RQ) Values from Foliar Applications of Acetamiprid at 0.52 lbs ai/A

Caste of Task in Hive	Average age (Days)	Brood Jelly (mg/day)	Nectar (mg/day)	Pollen (mg/day)	Total dose (µg a.i./bee)	Acute RQ *Oral LD_{50}: 21.73 µg a.i./bee*	Chronic RQ *NOAEL: 2.42 µg a.i./bee*
Worker	1	1.9	0	0	0.001	<0.01	<0.01
	2	9.4	0	0	0.005	<0.01	<0.01
	3	19.0	0	0	0.011	<0.01	<0.01
	4	0	60	1.8	3.535	0.16	0.29
	5	0	120	3.6	7.070	0.33	0.58
Drone	6+	0	130	3.6	7.642	0.35	0.63
Queen	1	1.9	0	0	0.001	<0.01	<0.01
	2	9.4	0	0	0.005	<0.01	<0.01
	3	23.0	0	0	0.013	<0.01	<0.01
	4+	141.0	0	0	0.081	<0.01	<0.01

4.1.D. RQ Values for Terrestrial Plants

For non-listed monocots there are exceedances of the risk LOC (1.0) from both aerial and ground applications at 0.52 lbs a.i./A, but only for plants inhabiting semi-aquatic environments (**Table 35**). For listed monocots there are exceedances of the risk LOC (1.0) from both aerial and ground applications at 0.15, 0.249 or 0.52 lbs a.i./A for plants inhabiting semi-aquatic environments. For non-listed dicots there are exceedances of the risk LOC from spray drift resulting from aerial applications at 0.15, 0.249 or 0.52 lbs a.i./A. There are also exceedances of the risk LOC for non-listed dicots inhabiting semi-aquatic environments after aerial or ground applications at 0.52 lbs a.i./A. For listed dicots there are exceedances of the risk LOC (1.0) from both aerial and ground applications at 0.15, 0.249 or 0.52 lbs a.i./A for plants inhabiting semi-aquatic environments, and also plants exposed via spray drift.

Table 35. Risk Quotient (RQ) Values for Non-Listed and Listed Monocotyledonous and Dicotyledonous Terrestrial Plants in Dry and Semi-Aquatic Areas Exposed to Acetamiprid via Runoff and/or Spray Drift, From TerrPlant EECs

Exposure Scenario	Monocots		Dicots	
	Non-listed Spp.	Listed Spp.	Non-listed Spp.	Listed Spp.
AERIAL APPLICATIONS				
Rate Scenario #1: 0.15 lbs a.i./A				

Exposure Scenario	Monocots		Dicots	
	Non-listed Spp.	Listed Spp.	Non-listed Spp.	Listed Spp.
Dry	<0.1	0.19	<0.1	0.19
Semi-aquatic	0.36	**1.07**	0.52	**1.07**
Spray Drift	<0.1	<0.1	**1.34**	**3.00**
Rate Scenario #2: 0.249 lbs a.i./A				
Dry	0.11	0.32	0.16	0.32
Semi-aquatic	0.60	**1.78**	0.86	**1.78**
Spray Drift	<0.1	0.16	**2.22**	**4.98**
Rate Scenario #3: 0.52 lbs a.i./A				
Dry	0.23	0.68	0.33	0.68
Semi-aquatic	**1.24**	**3.71**	**1.79**	**3.71**
Spray Drift	0.11	0.34	**4.64**	**10.40**
GROUND APPLICATIONS				
Rate Scenario #1: 0.15 lbs a.i./A				
Dry	<0.1	0.12	<0.1	0.12
Semi-aquatic	0.33	0.99	0.48	0.99
Spray Drift	<0.1	<0.1	0.27	0.60
Rate Scenario #2: 0.249 lbs a.i./A				
Dry	<0.1	0.19	<0.1	0.19
Semi-aquatic	0.55	**1.65**	0.79	**1.65**
Spray Drift	<0.1	<0.1	0.44	**1.00**
Rate Scenario #3: 0.52 lbs a.i./A				
Dry	0.14	0.41	0.20	0.41
Semi-aquatic	**1.15**	**3.44**	**1.66**	**3.44**
Spray Drift	<0.1	<0.1	0.93	**2.08**

BOLD: RQ values in bold exceed the risk level of concern (LOC) of 1.0.

4.1.E. Incident Database Review

The Incident Database System (IDS), which is maintained by the Agency's Office of Pesticide Programs, was searched to determine if ecological incidents have been reported for acetamiprid. Based on a search of IDS conducted in October 2017 there are a total of 94 incidents reported for acetamiprid, spanning 2004-2015. The majority of the reported incidents (55) involved adverse effects to terrestrial plants, 37 of the incidents involved adverse effects to bee species, while a single incident involved adverse effects to fish. The 55 plant incidents occurred with applications to gardens, ornamentals, and in residential areas. The certainty code for all but two of the plant incidents is "possible" (the other two are coded as "unlikely"). The magnitude of plants affected in each incident was up to >45%, and the range of plant species affected includes gardens, flowers, rose/parsley, trees, edible plants, rose bushes, and vegetables. These incidents suggest that there is the potential for effects to occur to terrestrial plants from the proposed uses of acetamiprid. However, the incidents to terrestrial plants reported in IDS all appear to be due to the use of two ready-to-use (RTU) product formulations (Acetamiprid RTU Insecticide [EPA Reg. No. 8033-21] & Acetamiprid Concentrate Insecticide [EPA Reg. No. 8033-107]) that contain 0.006% and 0.5% acetamiprid, respectively.

Six of the incidents involving bees were assigned a certainty index of "unlikely" association with acetamiprid, one was assigned a certainty index of highly probable, and the majority of the remaining incidents were characterized as "probable"; for four of the incidents there was no reported level of certainty. There were nineteen bee incidents and they all occurred in Ontario, Canada in 2012. Besides the majority of the incidents being categorized as "probable" there is little additional information provided regarding the incidents:

- One incident (I023702-003) spanned the years 2004-2006 and attributed hive population losses of 75-80% to Assail® (acetamiprid) or Admire® (imidacloprid) use on apples several months earlier; however, no dead bees were apparent soon after the applications. The certainty index for acetamiprid is reported as unlikely while that for imidacloprid was reported as possible.
- Another incident (I024270-001), which took place in May 2012, reported dead bees in 48 colonies while pollination services were being provided to an orchard containing apple, apricot, and plum trees. Apparently, Assail was not applied to the orchard until after bees had been removed from the area. Residue analysis in dead bee samples did not detect acetamiprid; however, the analysis detected other insecticides which are known to be more acutely toxic to bees. Based on this information, the role of acetamiprid in this incident is considered "unlikely."
- A third honey bee incident (I023979-002) took place on August 25, 2011 and was submitted in the form of an online news article. The incident occurred when a cotton field near the area where bees were being kept was sprayed with Assail® 70WP at 8:30 AM. All of the honey bees foraging in the cotton field were reported to have died. This incident occurred 10 days after a similar bee kill incident attributed to Lorsban (chlorpyrifos); a 60-80 percent loss of the beekeeper's honey bees were reported to have died across the two incidents. Given that a spraying of Assail® 70 WP (EPA Reg. No. 8033-23) was specifically associated with the bee kill, this incident is classified as "highly probable"; however, the application is classified as a misuse.
- The final bee kill incident (I024877-001) was reported in August 2012 and involved the loss of 70 – 80% of the bees in 120 bee hives after application of Belay® (clothianidin) to cotton while bees were foraging. Residue analysis detected both acetamiprid and clothianidin and, while the incident is listed as possibly associated with the use of acetamiprid, it is classified as a misuse.

The single aquatic incident (I022234-001) took place in 2010 that involved a fire in a chemical warehouse containing Assail 70 WP insecticide (TGAI: acetamiprid) as well as an unreported list of other pesticides and fertilizers. Water used to extinguish the fire resulted in runoff into a river that was ultimately linked to a fish kill of 700 to 1000 fish of unknown species. Since it is not possible to link any one chemical to this incident, the role of acetamiprid has been designated as "possible."

A total of 78 aggregated incidents have been reported in the Office of Pesticide Programs Incident Data System (IDS) as of October 24, 2017 (with the report covering 10/1/04 – 6/30/16). Seventy-four of these incidents involved damage to plants, and four incidents were reported for wildlife. Incidents involving damage to plants largely appeared to be due to the use of two ready-to-use (RTU) product formulations ("Acetamiprid RTU Insecticide" [EPA Reg. No. 8033-21] & "Acetamiprid Concentrate Insecticide" [EPA Reg. No. 8033-107]) that contain 0.006% and 0.5% acetamiprid, respectively. Two of the incidents involving terrestrial plants involved the use of a "Acetamiprid + Triticonazole Concentrate Insecticide & Fungicide" (0.26% acetamiprid + 0.78% triticonazole, EPA Reg. No. 8033-108), and one of the terrestrial plant incidents involved the use of TriStar® 70 WSP (70% ai, EPA Reg. No. 8033-22). The wildlife incidents involved single incidents resulting from use of the following products: Assail® 70 WP; "Acetamiprid RTU Insecticide"; F4688 50 WSP Insecticide Termiticide (22.73% acetamiprid + 27.27% bifenthrin, EPA Reg. No. 8033-96); F5688 11% ME Insecticide Termiticide (5% acetamiprid + 6% bifenthrin, EPA Reg. No. 8033-109). Incident reports for non-target organisms typically provide information only on mortality events and plant damage. Sublethal effects in organisms such as abnormal behavior, reduced growth, or impaired reproduction are rarely reported, except for phytotoxic effects in terrestrial plants.

The American Bird Conservancy Avian Incident Monitoring System was searched in April 2015 and returned no records of incidents associated with acetamiprid[22].

Although there are multiple incident reports associated with the use of acetamiprid, it is possible that additional incidents have occurred but have not been reported. In addition, incident reports for non-target plants and animals typically provide information on acute mortality events only. Reports for other adverse effects, such as reduced growth or impaired reproduction, are rarely received. Available incident information indicates that use of acetamiprid has the potential to result in effects to non-target terrestrial plants and bees. Although bee kill incidents have been associated with the use of acetamiprid on cotton and apples, the incidents were listed as misuses.

4.2. Risk Description

This assessment of the evaluated uses of acetamiprid relies on the deterministic RQ method to provide a metric of potential risks. For the assessed taxonomic groups, RQs exceed their respective LOC values for:

- Freshwater invertebrates (acute non-listed & listed LOCs, and chronic risk LOCs);
- Estuarine/marine invertebrates (acute non-listed & listed LOCs, and chronic risk LOCs);
- Birds (acute non-listed & listed LOCs, and chronic risk LOCs based on seed treatment uses);
- Mammals (acute listed LOCs based on some foliar uses, acute non-listed & listed LOCs, and chronic risk LOCs based on seed treatment uses); and,
- Terrestrial invertebrates (acute and chronic risk LOCs).
- Terrestrial plants (non-listed and listed LOCs)

4.2.A. Risk to Aquatic Organisms

Aquatic Exposure

Acetamiprid is characterized as moderately mobile, and depending on the extent to which the degradate IM 1-4 is included in exposure estimates, the residues may persist in the environment and can move to surface waters via spray drift, or runoff. The primary route of degradation is aerobic soil metabolism. Degradation rates were estimated for the parent alone, and parent plus IM 1-4. Depending on the ROCs considered and the environmental matrix acetamiprid DT_{50} values range from days to years. Acetamiprid is not likely to bioconcentrate (FAO, 2000; USEPA, 2012b).

Surface water and benthic sediment pore-water EECs were determined only for crops with high usage, unique use patterns that would require a different exposure model, or for uses that would allow bounding of the risk estimates. Some labels require a medium drop size distribution (DSD) for both aerial and ground applications. EECs simulated for ground applications assuming a fine to medium coarse DSD[23] (1.7% spray drift fraction) were 37 to 93% of EECs assuming the default very fine to fine DSD (6.2% spray drift fraction). For aerial applications, EECs assuming a medium to coarse DSD (8.9% spray drift fraction) were 73 to 94% of EECs assuming the default fine to medium DSD (12.5% spray drift fraction). EECs simulated assuming no spray drift occurred were 15 to 92% of EECs assuming spray drift did occur for the ground simulations. The range of the runoff only EEC percentages illustrate that spray drift was a major driver in the exposure estimate in some modeling scenarios but not in others. The percentage is

[22] Available at: http://www.abcbirds.org/abcprograms/policy/toxins/aims/aims/index.cfm

[23] Standard options in AGDRIFT for modeling spray drift for ground applications include: very fine to fine and fine to medium/coarse.

PWC scenario-specific (USEPA, 2013b). For areas vulnerable to runoff, the relative contribution of spray drift to the final EEC is expected to be minimal (*i.e.*, EECs calculated with and without simulation of spray drift would be similar).

Aquatic Animals

Although fish (freshwater and estuarine/marine) do not appear to be particularly sensitive to acetamiprid, freshwater and estuarine/marine invertebrates, and particularly benthic-dwelling (*e.g.* chironomids and mysid shrimps) species, are sensitive. Effects on survival of aquatic invertebrates were observed in acute toxicity studies at concentrations lower than those estimated in the environment from the evaluated use patterns of acetamiprid. Acute RQ values reflecting residues of parent plus IM 1-4 from foliar agricultural uses range from 0.52 to 1.78 for freshwater invertebrates, and 0.16 to 0.57 for estuarine/marine invertebrates. These risk estimates indicate a potential for acute mortality to occur among sensitive aquatic invertebrates from exposure as a result of the evaluated use patterns of acetamiprid in areas vulnerable to runoff and spray drift exposure. Daily average and 21-day average EECs in the water-column for parent plus IM 1-4 are up to 37.3 and 36.4 µg a.i./L, respectively.

With chronic exposure, an approximate 10% reduction in body weight in male mysid shrimp was observed (LOAEC=4.7 µg a.i./L). Reduced offspring production (LOAEC=9 mg a.i./L), and a reduction in the number of young per female (LOAEC= 51 mg a.i./L) were observed in *D. magna* at concentrations above the EECs. As noted previously, the available acute toxicity data indicate that *C. riparius* (48-hour LC_{50} of 21 µg a.i./L) is several orders of magnitude more sensitive to acetamiprid on an acute exposure basis than *D. magna* (48-hour LC_{50} of 5000 µg a.i./L). No chronic toxicity data are available for chironomids, but the studies with daphnids, midges and mysid shrimp were all with spiked water, so, although midges are typically benthic-dwelling organisms (and we would typically have sediment-based toxicity data available for such species), the available study data on the aquatic invertebrates are comparable across taxa. Therefore, the available acute (LC_{50}=0.066 mg ai/L) and chronic toxicity data (NOAEC=0.0025 mg ai/L) for mysid shrimp were used to calculate an ACR of 26.4, and applying this ACR to the acute toxicity endpoint for chironomids results in an estimated NOAEC of 0.0008 mg ai/L. Consequently, based on water-column EECs, there are exceedances of the chronic risk LOCs for both freshwater and estuarine/marine invertebrates, with RQs ranging from 13.13 to 45.50 and 4.20 to 14.56, respectively. For aquatic invertebrates, chronic risk LOCs are also exceeded for all evaluated use patterns, even if the contribution of spray drift is removed from the exposure simulation.

Based on the most sensitive available endpoints, one risk concern is for freshwater and estuarine/marine invertebrates inhabiting both the water column and benthic environments. Given the range of K_{OC} values for acetamiprid, the compound is not expected to appreciably partition to benthic sediments. However, pore-water EECs were 71 to 93% of the water-column EECs in the corresponding scenario, demonstrating that EECs in pore-water are high enough to result in LOC exceedances for sediment-dwelling aquatic invertebrates.

While any buffer between an application and aquatic water body is expected to reduce exposure and thereby risk, a methodology is not available to quantify the magnitude of such reductions in EECs due to transport in runoff, in part because channelized runoff may occur and reduce the effectiveness of buffers. Therefore, there is a potential for adverse effects (*e.g.*, mortality, reduced growth, reductions in the number offspring, and a reduction in the number of young per female) to aquatic invertebrates inhabiting both the water-column and benthic zones of receiving waters, resulting from the agricultural uses of acetamiprid applied as a foliar spray.

Pore water-based and sediment-based toxicity data for sediment-dwelling (benthic) organisms are not available, and so RQs are calculated using water-column endpoints for aquatic invertebrates[24]. Pore-water EECs are 70-95% lower than the water-column EECs used to calculate RQ values, and so the RQ values based on water-column EECs are presumed to be protective of those based on pore-water EECs. When spray drift exposure is not included in the simulation for the use pattern that resulted in the highest EECs, RQs still exceed the acute risk to listed and non-listed species LOC and chronic risk LOCs for aquatic invertebrates.

For risk characterization purposes, exposure by aquatic invertebrates to residues of parent acetamiprid alone were considered (**Table 36**). Acute risk LOCs for both listed and non-listed freshwater invertebrates are still exceeded for all evaluated uses, as are chronic risk LOCs for freshwater and estuarine/marine invertebrates. However, in general all RQs decrease substantially when based on parent only water column EECs. Specifically, acute RQs for freshwater invertebrates are reduced by an average of 36, 43, 51 and 78%, respectively, for the following uses: low-growing berries (3 CC), cotton and leafy vegetables; pome fruits, citrus and low-growing berries (1 CC); fruiting vegetables, tree nuts and ornamentals; and, cranberry (PFAM). Chronic RQs for freshwater invertebrates are reduced by an average of 35, 41, 45, and 50%, respectively, for the following uses: low-growing berries (3 CC), cotton, and leafy vegetables; pome fruits and citrus; low-growing berries (1 CC), fruiting vegetables and tree nuts; and, ornamentals and cranberry (PFAM).

Based on parent acetamiprid alone, acute risk LOCs for listed estuarine/marine species are exceeded for all uses, and acute risk LOCs for non-listed species are exceeded for all but the cotton and low-growing berries (1 CC) uses. Acute RQs for estuarine/marine invertebrates are reduced by an average of 12, 37, 43, 49, 56 and 77%, respectively, for the following uses: low-growing berries (3 CC); low-growing berries (1 CC) and citrus; ornamentals, tree nuts and cotton; pome fruits and cranberry (PFAM); fruiting vegetables; and, leafy vegetables. Chronic RQs for estuarine/marine invertebrates are reduced by an average of 10, 35, 42, 51, and 76%, respectively, for the following uses: cotton; low-growing berries (3 CC) and leafy vegetables; pome fruits, citrus, tree nuts, low-growing berries (1 CC) and fruiting vegetables; ornamentals; and, cranberry (PFAM).

Table 36. Risk Quotients (RQs) for Direct Effects to Aquatic Invertebrates Inhabiting the Water-column from the Evaluated Aerial Uses of Acetamiprid (on the Basis of Residues from Parent Acetamiprid Only)

Use Scenario	EECs (1-d/21-d/60-d, µg a.i./L)	Freshwater Invertebrates		Estuarine/Marine Invertebrates	
		Acute Chironomid EC_{50} = 21 µg a.i./L	Chronic Daphnid NOAEC = 5,000 µg a.i./L[1]	Acute Mysid EC_{50} = 66 µg a.i./L	Chronic Mysid NOAEC = 2.5 µg a.i./L
Citrus	10.9/10.0/8.6	**0.52**	12.50	**0.17**	**4.00**
Cotton	10.3/9.8/8.9	**0.49**	12.29	0.05*	**1.12**
Cranberry (PFAM)[4]	29.0/27.6/26.3	**0.94**	22.63	**0.44**	**11.04**
Fruiting Vegetables	11.4/10.6/9.2	**0.55**	13.25	**0.17**	**4.24**
Leafy Vegetables	7.0/6.7/6.2	**0.33**	8.33	**0.11**	**2.66**

[24] Using water-column toxicity data to predict toxicity to benthic aquatic invertebrates is a standard practice in evaluating the potential for sediment toxicity to occur (USEPA, 2014c).

Use Scenario	EECs (1-d/21-d/60-d, µg a.i./L)	Freshwater Invertebrates		Estuarine/Marine Invertebrates	
		Acute Chironomid EC_{50} = 21 µg a.i./L	Chronic Daphnid NOAEC = 5,000 µg a.i./L[1]	Acute Mysid EC_{50} = 66 µg a.i./L	Chronic Mysid NOAEC = 2.5 µg a.i./L
Low-growing Berries (1 CC)[3]	4.9/4.6/4.2	**0.23**	5.78	0.07*	**1.85**
Low-growing Berries (3 CC)[3]	11.2/10.3/8.7	**0.54**	12.88	**0.17**	**4.12**
Ornamentals Grown in Fields/ Plantations	15.6/14.1/11.2	**0.75**	17.63	**0.24**	**5.64**
Pome Fruit	9.8/9.3/8.5	**0.47**	11.61	**0.15**	**3.72**
Tree Nuts	11.0/10.1/8.7	**0.53**	12.63	**0.17**	**4.04**

A **bold** value indicates that the RQ meets or exceeds the acute listed (0.05) and non-listed (0.1) LOC, or the chronic risk LOC (1.0). An asterisk ("*") on an acute value indicates that only the acute listed species LOC (0.05) is exceeded.
[1] The NOAEC used to calculate risk quotient for freshwater invertebrates inhabiting the water-column was calculated using data for *D. magna* which are not the most sensitive aquatic invertebrates based on acute toxicity.
[2] Toxicity endpoints are based on water-column toxicity studies because sediment pore water toxicity endpoints are not available.
[3] The labels allow for use on crop group 13-07 G low growing berries (including cranberries). This RQ would be representative for uses on cranberries and other low growing berries that are not intermittently flooded.
[4] Pore-water EECs were not calculated for use on cranberries. However, the EECs for the cranberry use pattern are expected to be similar to those captured in this table for other use patterns.

Monitoring data for surface water (peak=44.1 µg/L) indicate that acetamiprid is moving into surface waters and resulting in concentrations in playas in Texas near where acetamiprid was applied that are within the range of toxicity endpoints for aquatic invertebrates. These monitoring studies are not expected to have captured actual maximum concentrations because the sampling was infrequent and not necessarily targeted to areas with known acetamiprid use. These data support the potential for acetamiprid exposure could result in adverse effects to aquatic invertebrates. These data are not expected to be predictive of exposure in the EPA pond; however, the fact that measured concentrations are occurring in the environment at levels where effects are occurring in toxicity studies, is a line of evidence that the exposure in the field may occur at levels where adverse effects are expected to occur in aquatic invertebrates.

Formulation toxicity data for acetamiprid products demonstrated less sensitive toxicity endpoints as compared to the endpoint for technical grade acetamiprid; however, data are not available for all formulations (*e.g.*, for the product containing acetamiprid and bifenthrin [CAS No. 82657-04-3]). For the majority of formulations, the available product data suggests that reliance on acetamiprid alone is protective. For acetamiprid mixed with bifenthrin, there are no data available.

Acetamiprid may be detoxified by the cytochrome P450 system (Khan *et al.* 2013). Evidence suggests that exposure to both acetamiprid and P450 inhibitors could enhance toxicity compared to that of acetamiprid alone for terrestrial invertebrates (Iwasa *et al.*, 2004). There are insufficient data to inform any extrapolation to aquatic invertebrates for acetamiprid. Some synergists such as piperonyl butoxide (PBO, CAS No. 51-03-6) may block the cytochrome P450 enzyme and have the potential to increase the toxicity of acetamiprid to aquatic invertebrates and other organisms. The labels do not have a recommendation to tank mix with PBO. The team has not evaluated the usage data to determine whether acetamiprid is commonly used with P450 inhibitors.

Exposure and subsequent risk from flooded-field cranberry uses is highly dependent on the processing of water used for production. As previously discussed, the modeled EECs are intended to represent exposure in the cranberry bog. They are also used to assess risk in downstream receiving water bodies (*i.e.*, waterbodies that receive the acetamiprid-contaminated water released from the bog). The EECs for the cranberry bog and release water are based on a point-to-point flow of uncontaminated water through a single acetamiprid-treated bog. The EECs do not account for recycling of that same water back through the same acetamiprid-treated bog. Likewise, the EECs do not account for recycling of water through multiple acetamiprid-treated bogs. In both cases, the practice of recycling may lead to greater exposure concentrations given that acetamiprid total ROC are persistent. However, EECs in receiving water bodies may be lower than those estimated in the cranberry bog as a result of processes such as degradation in the water column, absorption by sediment, and dilution with uncontaminated water from other sources in the adjacent waterways.

Overall, direct risks to fish (freshwater and estuarine/marine) and aquatic plants (non-vascular and vascular) are not expected for the evaluated uses of acetamiprid, although there are some areas of potential uncertainty. In fish, acetamiprid is slightly toxic to practically non-toxic on an acute exposure basis when mortality is the endpoint of focus.

The residential and seed treatment use patterns did not result in any LOC exceedances for aquatic organisms.

4.2.B. Risk to Terrestrial Organisms

Birds and Mammals

Although upland game birds such as bobwhite quail and waterfowl such as mallard ducks are not particularly sensitive to acetamiprid on an acute oral or subacute dietary exposure basis, passerine species appear to be sensitive to acetamiprid. Acetamiprid is categorized as very highly toxic (passerine species) to birds on an acute oral exposure basis and a subacute dietary exposure basis. Acetamiprid is categorized as being highly toxic to mammals on an acute oral exposure basis.

For the evaluated use patterns of acetamiprid, acute dose-based RQ values exceed the LOC for acute risk to listed (RQ≥0.1) and non-listed (RQ≥0.5) species for all size classes under all of the evaluated use scenarios for all dietary items except for fruits/pods and seeds. Under the citrus, ornamental, pome fruit and tree nut use scenarios there are also exceedances of the LOC for acute risk to listed (RQ≥0.1) and non-listed (RQ≥0.5) birds for small- and medium-sized animals. Sub-acute dietary-based RQ values, exceed the LOC for acute risk to listed (RQ≥0.1) and/or non-listed (RQ≥0.5) birds for all dietary items except for fruits/pods under all use scenarios except for the two low-growing berry scenarios. A point of concern regarding the passerine study results is that the difference in test substance concentrations at which no mortality (2.5 mg/kg-bw) and complete mortality (10 mg/kg-bw) was observed in test birds is small. These data indicate that acetamiprid has a relatively steep dose-response relationship in passerine birds and that relatively small shifts in application rate could have potentially marked effects on numbers of birds affected. Taken together, these data suggest that acetamiprid may pose a direct risk to similarly sensitive birds across all size classes and foraging categories evaluated.

As noted in the risk estimation section, when calculated using the measured mallard duck NOAEC value (99 mg a.i./kg diet), there are exceedances of the chronic risk LOC (RQ≥1) for short grass consumption under the citrus, ornamental, pome fruit and tree nut use scenarios. However, mallards are not the most sensitive species when tested for acute oral and subacute dietary toxicity. Rather, the zebra finch are more sensitive on the basis of acute and sub-acute exposure, and presumably would be more sensitive on a chronic exposure basis as well. This suggests that the chronic RQ based on the mallard NOAEC may underestimate the potential for adverse effects for smaller birds, reptiles and terrestrial-phase amphibians.

Mallard ducks exposed to acetamiprid in the diet at 99 mg a.i./kg-diet for 20 weeks, had reduced food consumption, reduction in fraction of eggs not cracked out of eggs laid, and additional adverse effects. At 402 mg/kg-diet there were additional reductions in adult female body weight and in the number of eggs laid per hen. Dietary EECs range from 5 to 118 mg/kg-diet for maximum label rates, and some EECs are higher than the concentration at which effects were observed in mallards, *i.e.*, exceed the LOAEC.

There are no RQs exceeding the acute risk LOC for non-listed species (RQ≥0.5) of mammals under any use scenario, nor are there any chronic dietary-based RQ exceedances of the mammalian chronic risk LOC (RQ≥1) under any use scenario. For the evaluated uses of acetamiprid, there are exceedances of the LOC for acute risk to listed (RQ≥0.1) species foraging on short grass under the citrus, ornamental, pome fruit and tree nut use scenarios, and also acute risk LOC exceedances for small and medium-sized listed species foraging on tall grass, broadleaf plants/small insects, and arthropods for the citrus, ornamental, pome fruit and tree nut use scenarios.

The risk estimation from seed treatment uses identified acute dose-based risk estimates for birds of all size classes from canola, mustard or potato use scenarios, but area-based risk to only small and medium-sized birds from consumption of canola or mustard seed. According to EFED's *Refinements for Risk Assessment of Pesticide Treated Seeds – Interim Guidance* (and data derived from Benkman and Pulliam 1988[25]), the maximum size seed that an average 20-g passerine bird will consume is 60 mg, and the maximum size seed a 100-g passerine bird will consume is 120 mg. Based on an average weight of one canola or mustard seed (roughly 4.56 mg), these seeds could be consumed by any size of bird. On the other hand, the average seed potato weighs roughly 60 g, and so it is likely too large to be consumed by smaller-sized birds. If the most sensitive toxicity estimates for birds are reflective of the sensitivity of passerines alone, according to USEPA (2015) there are 117 common species of birds associated with agricultural fields or their adjacent edge habitats and 89 (76%) of those species are passerines.

While there is some uncertainty with using size of seed as a limiting factor for consumption by all passerine species based on toxicity data from only a few species, EFED considers this approach reasonable for foraging birds. Based on the preliminary analysis above, it is reasonable to discount the acute and dietary risks from consumption of seed potato by foraging passerine birds given the large size of the seed. There is some uncertainty with the degree to which larger bird species would consume seed potatoes, but risk from this exposure scenario is considered to be minimal given the typical planting depth (~6 in) of seed potatoes. From consumption of canola and mustard, there are dose-based LOC exceedances for all size classes of listed and non-listed birds, and there are area-based LOC exceedances for small non-listed species, and both small- and medium-sized listed species. Further analysis of the estimated number of seeds to reach the acute risk LOC for non-listed species indicates that passerine birds of any size class would only need to eat a small portion of their diet (<5%) as treated canola or mustard seeds to be exposed to potentially toxic levels of acetamiprid (**Table 37**). Furthermore, the area that bird would need to forage to consume this amount of seed (*i.e.*, the foraging area of concern) represents a small fraction (<0.1%) of the estimated home range of each size class based on standard body weight and allometric conversions.

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[25] Benkman, C.W. and H.R. Pulliam. 1988. Comparative Feeding Ecology of North American Sparrows and Finches. Ecology. 69: 1195—1199.

Table 37. Number of Seeds Required to Reach the Acute Risk LOC for Non-listed Species (0.5), % Diet, and Associated Foraging Parameters for Passerine Bird Size Classes

Bird Size	Seed (weight in mg)	# Seeds to Reach LOC	% Diet seeds to reach LOC[1]	Foraging Area of Concern (ha)	% Home Range [2]
Small (20 g)	Canola (4.5 mg)	5.4	0.5	0.0009	0.06
Medium (100 g)		34.2	1.1	0.0057	0.07
Large (1000 g)		483.2	3.4	0.0799	0.07
Small (20 g)	Mustard (4.5 mg)	6.3	0.6	0.0008	0.05
Medium (100 g)		39.9	1.2	0.0049	0.06
Large (1000 g)		563.6	3.9	0.0685	0.06

[1] Assuming 100% of diet is treated seed.
[2] Standard range size assumptions are as follows: small birds – 1.4 ha; medium birds – 8.7 ha; and, large birds – 114.5 ha.

The risk estimation from seed treatment uses identified chronic dietary-based risk to birds of all size classes from canola, mustard or potato use scenarios based on the sensitivity of mallard duck. Again, based on the preliminary analysis of average seed sizes, it is reasonable to discount the chronic risks from consumption of seed potato by foraging birds given the large size of the seed potato. There are notable uncertainties related to chronic risks from seed treatments, including whether the most sensitive effects (in this case decreased food consumption among other effects) occurs at a particularly sensitive life stage or are due to the exposure period as a whole. This consideration is relevant when accounting for how many seeds an organism would have to consume to elicit the toxicological effects. Based on the NOAEC (99 mg ai/kg diet), the quantity of canola seed that would need to be consumed to exceed the chronic risk LOC represent 7.8-30.6% of the bird's likely foraging diet (**Table 38**). For mustard seed consumption, seed quantities that would need to be consumed to exceed the chronic risk LOC represent 9.1-35.8% of the bird's likely foraging diet. Considering that there are doses between the NOAEC and LOAEC where exceedances begin (with the caveat that even at the LOAEC adverse effects of roughly 50% were reported for some endpoints), the same analysis can be performed using the LOAEC value, which results in seed quantities necessary to exceed the chronic risk LOC of 31.8 to >100% for canola seed, and 37.1 to >100% for mustard seed).

Table 38. Number of Seeds Required to Reach the Chronic Risk LOC for Non-listed Species (1), % Diet, and Associated Foraging Parameters for Passerine Bird Size Classes

Bird Size	Seed (weight in g)	# Seeds to Reach LOC	% Diet seeds to reach LOC[1]	Foraging Area of Concern (ha)	% Home Range [2]
Based on NOAEC (99 mg ai/kg diet)					
Small (20 g)	Canola (4.5 mg)	88	7.8	0.0146	1.04
Medium (100 g)		440	13.7	0.0728	0.84
Large (1000 g)		4401	30.6	0.7275	0.64
Small (20 g)	Mustard (4.5 mg)	103	9.1	0.0125	0.89
Medium (100 g)		513	16.0	0.0624	0.72
Large (1000 g)		5133	35.8	0.6236	0.54
Based on LOAEC (402 mg ai/kg diet)					
Small (20 g)	Canola (4.5 mg)	357	31.8	0.0591	4.22
Medium (100 g)		1787	55.7	0.2954	3.40
Large (1000 g)		17869	>100	2.9541	2.58
Small (20 g)	Mustard (4.5 mg)	417	37.1	0.0506	3.62
Medium (100 g)		2084	65.0	0.2532	2.91
Large (1000 g)		20843	>100	2.5321	2.21

[1] Assuming 100% of diet is treated seed.
[2] Standard range size assumptions are as follows: small birds – 1.4 ha; medium birds – 8.7 ha; and, large birds – 114.5 ha.

For mammalian risk due to seed treatments, dose-based RQ exceed the acute and chronic risk LOC for mammals through consumption of treated canola and mustard seeds by all size classes. As there were no acute or chronic risks of concern indicated by the analysis for consumption of potato seed, this use scenario is not analyzed further. Analysis of the estimated number of canola or mustard seeds that would need to be consumed to reach the acute risk LOC for non-listed species indicates that small- and medium-sized mammals would need 30-41% of their diets solely as treated seed to exceed the acute risk LOC for non-listed species (**Table 39**). The foraging area of concern for small- and medium-sized mammals consuming treated canola or mustard seeds represents 2.4 and 0.7%, respectively, of their estimated home range. Analysis of seed treatment risks to large mammals suggests that LOC exceedances may occur only for large mammals consuming either canola or mustard seeds, for which the amount of seed required to exceed the acute risk LOC represent a 66-77-5.8% portion of their diets, and 0.6-0.7% of their likely home ranges.

Table 39. Number of Seeds Required to Reach the Acute Risk LOC for Non-listed Species (0.5), % Diet, and Associated Foraging Parameters for Mammal Size Classes

Mammal Size	Seed (weight in g)	# Seeds to Reach LOC	% Diet seeds to reach LOC[1]	Foraging Area of Concern (ha)	% Home Range [2]
Small (15 g)	Canola (4.5 mg)	214	30	0.0354	2.53
Medium (35 g)		404	35	0.0668	0.77
Large (1000 g)		4992	66	0.8252	0.72
Small (15 g)	Mustard (4.5 mg)	250	35	0.0303	2.17
Medium (35 g)		471	41	0.0572	0.66
Large (1000 g)		5823	77	0.7074	0.62

[1] Assuming 100% of diet is treated seed.
[2] Standard range size assumptions are as follows: small birds – 1.4 ha; medium birds – 8.7 ha; and, large birds – 114.5 ha.

The risk estimation from seed treatment uses identified chronic dietary-based risk to mammals of all size classes from canola, or mustard use scenarios. Based on the NOAEC (160 mg ai/kg diet), the quantity of canola seed that would need to be consumed to exceed the chronic risk LOC represents 15-22% of a small- or medium-sized mammal's likely foraging diet, and 94% of large mammal's foraging diet (**Table 40**). For mustard seed consumption, seed quantities that would need to be consumed to exceed the chronic risk LOC represent 18-26% of a small- or medium-sized mammal's likely foraging diet, and >100% of a large mammal's foraging diet. Considering that there are doses between the NOAEC and LOAEC where exceedances begin, the same analysis can be performed using the LOAEC value, which yields seed quantities that are roughly double the quantity of seed (*i.e.*, 0.9-9.4% for canola seed, and <0.1-0.8% for mustard seed).

Table 40. Number of Seeds Required to Reach the Chronic Risk LOC for Non-listed Species (1), % Diet For Mammal Size Classes with LOC Exceedances

Bird Size	Seed (weight in g)	Based on NOAEC (160 mg ai/kg diet)		Based on LOAEC (400 mg ai/kg diet)	
		# Seeds to Reach LOC	% Diet seeds to reach LOC[1]	# Seeds to Reach LOC	% Diet seeds to reach LOC[1]
Small (15 g)	Canola (4.5 mg)	107	15	267	38
Medium (35 g)		249	22	622	55
Large (1000 g)		7112	94	17780	>100
Small (15 g)	Mustard	124	18	311	44

Bird Size	Seed (weight in g)	Based on NOAEC (160 mg ai/kg diet)		Based on LOAEC (400 mg ai/kg diet)	
		# Seeds to Reach LOC	% Diet seeds to reach LOC[1]	# Seeds to Reach LOC	% Diet seeds to reach LOC[1]
Medium (35 g)	(4.5 mg)	290	26	726	64
Large (1000 g)		8296	>100	20739	>100

[1] Assuming 100% of diet is treated seed.

Estimation of chronic risk to mammals following likely exposure to acetamiprid from the modeled uses was based on a NOAEC value of 160 mg a.i./kg-diet based on adverse effects on growth from a 2-year chronic feeding study (MRID 44988429). In this study, statistically significant ($p<0.05$) reductions in body weight were reported in both male and female rats at the LOAEC (400 mg a.i./kg diet) and at 1000 mg a.i./kg diet. In a two-generation reproduction study (MRID 44988430), statistically significant ($p<0.05$) reductions (relative to the control treatment group) in male rat body weight were reported for individuals at the LOAEC (800 mg a.i./kg diet); whereas, no significant adverse effects were reported for individuals in the 280 mg a.i./kg diet treatment group. This latter type of mammalian effects study is commonly used as the basis for risk estimation, but in this case was not due to the lower growth-related endpoint reported by the former study. Even with using 160 mg a.i./kg diet as the chronic toxicity endpoint for risk estimation, all resulting RQs are <0.78 (well below the chronic risk LOC of 1.0). However, if the NOAEC from the two-generation reproduction study (280 mg a.i./kg diet) is used for risk estimation for acetamiprid, RQs would be reduced by 40-50% relative to those based on the more sensitive endpoint.

The preceding risk characterization for birds and mammals following likely exposure to acetamiprid i0s based on T-REX modeling using the default 35-day foliar dissipation half-life which would be protective for both parent and IM-1-4. In order to further characterize possible risk to birds and mammals, as a bounding exercise avian and mammalian risk quotients were calculated using a shorter foliar dissipation half-life of roughly 6 days to assess the influence of foliar dissipation on terrestrial exposure and risk to birds and mammals. Overall, with the reduced foliar dissipation half-life (roughly 17.5% of the default 35-day foliar dissipation half-life), RQ values for birds were reduced by 22-54% (*i.e.*, 22, 36, 48 and 54%, respectively, for berries (single crop cycle) and citrus, berries (three crop cycles), cotton and leafy vegetables, and pome fruits and tree nuts) for all size classes of birds for all use scenarios except the ornamental use scenario. The ornamental use scenario represented the highest maximum single application rate (0.52 lbs a.i./A), and RQ values do not change when decreasing the foliar dissipation half-life

Overall, with the exception of the ornamental use scenario (for which again the RQ value is unchanged), RQ values for acute exposure by small mammals consuming short grass are reduced by an average of 19, 33, 47 and 55%, respectively, for berries (single crop cycle) and citrus, berries (three crop cycles), cotton and leafy vegetables, and pome fruits and tree nuts. While RQ values are reduced for both birds and mammals with the use of the shorter foliar dissipation rate, the overall pattern of risk remains unchanged in that there are still exceedances of the acute risk LOCs for listed and non-listed birds, and for listed mammals, for at least four food sources and all size classes under all modeled use scenarios. Reducing the foliar dissipation rate beyond roughly 6 days (*e.g.* setting it at '1'), does not further lower the RQs for birds and mammals.

Using the default foliar dissipation half-life (35-days), the acute risk LOC is exceeded to 187-198 and 269-279 days, respectively – bracketed at the low end by the leafy vegetable use scenario (maximum annual application rate of 0.375 lbs a.i./A), and at the high end by the ornamental use scenario (maximum annual application rate of 0.55 lbs a.i./A) - for non-listed and listed small birds consuming short grass (representing the highest exposure scenario). After reducing the foliar dissipation half-life to roughly 6 days, the acute risk LOC is exceeded to 36-44 and 50-58 days, respectively for non-listed and listed small birds consuming short grass. Using the default foliar dissipation half-life (35-days), the chronic risk LOC is exceeded to 31-53 days for birds consuming short grass. After reducing the foliar dissipation rate to roughly 6 days, the chronic risk LOC is exceeded to 1-10 days. For listed mammals, the acute risk LOC is exceeded to 56-70 days based on the 35-day foliar dissipation half-life, and 2-13 days based on the reduced foliar dissipation half-life. The chronic risk LOC for mammals is exceeded to 90-100 days based on the 35-day foliar dissipation half-life, and 19-24 days based on the reduced foliar dissipation half-life.

For the purposes of further characterization, mean Kenaga RQ values are also calculated for the standard 35-day (**Appendix L**) foliar dissipation half-life. Relative to the upper-bound Kenaga RQ values, mean Kenaga RQs are approximately 65% lower for birds and mammals. Even with mean Kenaga values (**Appendix L**) there are still exceedances of the acute risk LOC for both listed (RQ≥0.1) and/or non-listed (RQ≥0.5) birds for all size classes of birds for four dietary sources (short & tall grass, broadleaf plants/small insect, and arthropods) under the ornamental use scenario, for short grass and arthropod dietary sources for the citrus use scenario, and for short grass only under the tree nuts use scenario. There are also exceedances of the acute risk LOC for small- and medium-sized listed and non-listed bird species and for several food sources under the cotton, leafy & fruiting vegetables, low-growing berries, pome fruits and tree nuts use scenarios. Additionally, sub-acute dietary-based RQ values still exceed the LOC for acute risk to listed (RQ≥0.1) and/or non-listed (RQ≥0.5) birds for short grass and arthropod food items under the ornamental use scenario, and for short grass only under the citrus use scenario. Based on mean Kenaga estimates, there are no exceedances of the chronic risk LOC (RQ≥1) for any of the evaluated use scenarios when calculated using the measured mallard duck NOAEC.

The degradate IM 1-4 was chosen as a residue of concern for the purposes of aquatic exposure due to its similar (relative to parent acetamiprid) acute toxicity to freshwater aquatic organisms, and in particular Rainbow trout and daphnids. There are also available data that suggest similar toxicity for Mallard duck, but there are no data available on IM 1-4 toxicity for the more sensitive passerine birds such as zebra finch. As there are limited data on the toxicity of IM 1-4 to standard test species, there is some uncertainty regarding potential risk to organisms in the environment from exposure to IM 1-4. The uncertainty related to the IM -4 degradate to birds provides support for using the default 35-day foliar dissipation half-life as an input for the terrestrial exposure modeling.

Terrestrial Spray Drift Distance

It is useful to know how far from the edge of the field spray drift exposure alone could result in risk to birds (*i.e.*, "distance of effect"). Similar to what was done for aquatic organisms, spray drift exposure to acetamiprid by birds was determined using AgDRIFT™ version 2.1.1 (USEPA, 2013b). The terrestrial spray drift distance was determined using Tier I ground (also air blast) and aerial terrestrial point deposition estimates, and using a fraction of the applied rate ("Fraction of Applied") based on the acute-dose based RQ for birds and either the acute listed (0.1) or acute non-listed LOC (0.5) (USEPA, 2004). The default American Society of Agricultural Engineers (ASAE) Fine to Medium droplet size distribution was assumed for aerial applications. For ground applications, a high boom, ASAE very fine to fine drop size distribution, and the 90th data percentile was assumed. These are the default spray drift inputs recommended for modeling spray drift (USEPA, 2013b).

The terrestrial spray drift distances (*i.e.*, the distance from the edge of the field where spray drift exposure could result in RQs that exceed LOCs) for risk to listed and non-listed birds are summarized in **Table 41**.

For listed species, the distance of effect for spray drift resulting from aerial applications is 433-958 ft from the application location depending on the specific use. The distance of effect for spray drift resulting from ground boom or airblast applications, respectively, is 118-200 and 226-361 ft from the application location depending on the specific use. For non-listed species, the distance of effect for spray drift resulting from aerial and ground boom and airblast applications are 95-161, 26-43, and 49-85, respectively. The terrestrial spray drift distance estimated for birds is protective of other terrestrial animals from effects due to exposure to spray drift.

Table 41. Range of Terrestrial Spray Drift Distances (ft) From the Evaluated Use Patterns for Acetamiprid

Use Pattern RQ	Distance (ft) from Edge of Field Where Spray Drift Could Result in RQs Greater than LOCs for Birds (feet)[1]	
	Listed Birds	Non-listed Birds
Aerial Application (Tier I, Fine to Medium DSD)		
Leafy & Fruiting Vegetable	433.1	95.1
Low Growing Berries[2]	439.6	95.1
Cotton	492.1	105.0
Pome Fruit	705.4	131.2
Citrus	784.1	141.1
Tree Nuts	885.8	150.9
Ornamentals	958.0	160.8
Ground Application (Tier I, Very fine to fine DSD, 90th data percentile, high boom)		
Leafy & Fruiting Vegetable	118.1	26.3
Low Growing Berries[2]	121.4	26.3
Cotton	134.5	29.5
Pome Fruit	170.6	36.1
Citrus	183.7	39.4
Tree Nuts	193.6	42.7
Ornamentals	200.1	42.7
Ground Airblast Application (Tier I, Very fine to fine DSD, 90th data percentile)		
Leafy & Fruiting Vegetable	226.4	49.2
Low Growing Berries[2]	229.7	49.2
Cotton	249.3	55.8
Pome Fruit	311.7	72.2
Citrus	331.4	75.0
Tree Nuts	347.8	82.0
Ornamentals	360.9	85.3

DSD=drop size distribution
[1] Estimated by calculating a fraction of the applied rate based on the acute listed LOC (0.1) or non-listed LOC (0.5) divided by the acute-dose based RQ value for the small bird consuming short grass for each use scenario. Note that for airblast the fraction of the applied is further multiplied by 0.5 (*i.e.*, [LOC/RQ] * 0.5).
[2] AgDRIFT analysis of terrestrial spray drift distances does not explicitly take into account number of crop cycles, so this use scenario is considered to be representative of either 1 or 3 crop cycles scenarios modeled elsewhere in this assessment.

Terrestrial Invertebrates

Although acute risk estimates indicate that adverse effects may occur to individual adult bees following ingestion of residues, colony-level (tunnel) studies and a full-field study with formulated product applied while bees were actively foraging do not indicate any long-term adverse effects on the colonies. While the tunnel study indicated that the number of foraging bees soon after application was significantly ($p<0.05$) lower than controls, the effect was transitory and overall colony performance was not impaired. Based on the available data, and at the maximum rate evaluated in the semi-field and field studies, *i.e.*, 0.089 lbs ai/A, applications at full bloom while bees were actively foraging did not result in increased acute mortality or immediate or long-term effects on adult bee or brood production.

Measured residues of acetamiprid are available from several studies in pollinator-attractive crops (*i.e.*, phacelia and oilseed rape). Peak residues in phacelia were 2.05 - 16.96 mg ai/kg in pollen, and 1.17 – 5.60 mg/kg in nectar on the day of application; whereas, maximum residue levels in oilseed rape pollen and nectar at three days after application were 0.178 and 0.128 mg ai/kg, respectively. These measured residues are substantially lower (70-98% for phacelia, and >99% for oilseed rape) than residue levels estimated in BeeREX for the corresponding application rate. While toxicity of residues on foliage studies indicate that the formulations of acetamiprid tested had RT25 values of <3hrs; these studies may not reflect exposure through residues that may be systemically translocated to pollen and/or nectar. Based on contact exposure, the toxicity of the compound to bees appeared to be well below 25% within 3 hrs after application. Empirical measures of exposure illustrate though that bees can be exposed to dietary concentrations of acetamiprid that can result in adverse effects on individual bees under laboratory test conditions; however, the colonies in which these residue levels were measured did not appear to be adversely affected in terms of overall performance.

Roughly half of ecological incidents associated with acetamiprid involved honey bee mortality; however, the majority (76%) of these incidents occurred outside of the U.S. (*i.e.*, in Ontario, Canada). Of the eight incidents that took place in the U.S., three were determined to be misuses; the legality of two additional uses were undetermined and two other uses the certainty index was "unlikely." The remaining incident in Oregon in 2016 was from a registered use on ornamentals with a certainty index of "possible." Therefore, while there are multiple incidents that have been associated with the use of acetamiprid, the quality of these data vary and the number of actual incidents in the U.S. is relatively limited compared with those in Canada. These incident reports, though, cannot be construed as the only incidents that may have occurred, as under-reporting of incidents is considered likely, particularly with respect to those involving bee kills as beekeepers can be reluctant to report such incidents due to concerns about offending growers on whom they may depend for pollination service contracts and/or forage areas for their colonies.

The acute risk LOC is exceeded for adult bees, but available data on the toxicity of acetamiprid to larval honey bees did not result in LOC exceedances, and colony-level studies do not indicate any long-term effect on adult or larval honey bees. While RQ values are based on the maximum single application rate of 0.52 lbs ai/A (ornamental use scenario), the available colony level studies examined application rates that were 5.8x lower than the maximum application rate (lower than most of the evaluated acetamiprid uses). Therefore, there is uncertainty whether application rates up to 0.52 lbs ai/A under field settings would represent a potential risk to honey bee colonies. Given that bumble bees were less sensitive than honey bees on both an acute oral and contact exposure basis, the likelihood of adverse effects on these social non-*Apis* bees is presumed to be low.

There were no LOC exceedances for honey bees for the seed treatment use patterns.

Terrestrial Plants

RQ values for terrestrial plants from aerial applications reported in the risk estimation section indicate that across the application scenarios evaluated, adverse effects to non-target terrestrial plants from exposure to acetamiprid are possible given that RQ values are above the terrestrial risk LOC of 1.0 under certain circumstances (see **Table 35**). Across the application scenarios, RQ values for monocots are highest in the semi-aquatic habitat exposure scenario (non-listed species: 0.36-1.24; listed species: 1.07-3.71). RQs for non-listed and listed dicot species are highest in the spray drift exposure scenario (non-listed species: 1.34-4.64; listed species: 3.00-10.40). RQ values for terrestrial plants from ground applications follow a similar pattern for monocots, in that (at least for the 0.249 and 0.52 lbs a.i./A application rates) RQs are highest in the semi-aquatic habitat exposure scenario (non-listed species: 0.55-1.15; listed species: 1.65-3.44). For dicots, however, RQ values from ground applications at 0.249 or 0.52 lbs a.i./A are highest for plants inhabiting semi-aquatic habitats and not those exposed via spray drift (non-listed species: 0.79-1.66; listed species: 1.65-3.44).

Particularly for aerial acetamiprid applications, spray drift posed a risk to terrestrial plant species. The AgDRIFT™ model was used to predict how changes in spray droplet sizes for both aerial and ground scenarios might minimize risk (see **Table 42)**. Changes in droplet size did not substantially affect risk for adverse vegetative vigor effects on monocots (NOAEC: 0.31 lbs a.i./A). For adverse seedling emergence effects on monocots, increasing droplet sizes reduces the distance of effect from 183 to 24 feet for listed species, and from 7 to 2 feet for non-listed species. Likewise, for adverse seedling emergence effects on dicots, increasing droplet sizes reduces the distance of effect from 183 to 24 feet for listed species, and from 47 to 8 feet for non-listed species. Regarding adverse vegetative vigor effects for dicots (based on a lettuce NOAEC of 0.0025 lbs a.i./A), the use of very coarse-coarse droplets reduces the distance of effect to 740 feet (from >1000 feet for very fine droplets) for listed species, and to 252 feet (from >1000 feet for very fine droplets) for non-listed species.

Table 42. Approximate distance (ft) from the application point – *i.e.* edge of the treated field – where the RQ falls below the risk to terrestrial plant LOC[1] for seedling emergence and vegetative vigor endpoints for the most sensitive monocot and dicot species. Analyses are based on AgDRIFT EECs using both ground and aerial application scenarios, various droplet size distributions, and the maximum single application rate of 0.052 lbs a.i./A.

ASAE Droplet Size Distribution	Seedling Emergence		Vegetative Vigor	
	Listed	Non-listed	Listed	Non-listed
Monocots[2] – Aerial Applications				
Very Fine-Fine	183	7	<1	<1
Fine-Medium	63	3	<1	<1
Medium-Coarse	30	2	<1	<1
Coarse-Very Coarse	24	2	<1	<1
Monocots[2] – Ground Applications				
Very Fine-Fine	6.5	1.5	1	<1
Fine-Medium/Coarse	<1	<1	<1	<1
Dicots[3] – Aerial Applications				
Very Fine-Fine	183	47	>1000	>1000
Fine-Medium	63	12	>1000	>1000
Medium-Coarse	30	9	>1000	395
Coarse-Very Coarse	24	8	740	252
Dicots[3] – Ground Applications				
Very Fine-Fine	6.5	3	210	87
Fine-Medium/Coarse	2	<1	90	30.5

[1] For non-listed plant species the comparison is made relative to the EC_{25} value for the most sensitive monocot or dicot, while for listed plant species the comparison is made relative to the NOAEC value for the most sensitive monocot or dicot.
[2] For monocots the endpoints used in AgDRIFT analyses were the following: seedling emergence, onion – EC_{25}: 0.23 lbs a.i./A and NOAEC: 0.077 lbs a.i./A; vegetative vigor, perennial ryegrass – EC_{25}:0.46 lbs a.i./A and NOAEC: 0.31 lbs a.i./A.
[3] For dicots the endpoints used in AgDRIFT analyses were the following: seedling emergence, cucumber – EC_{25}: 0.16 lbs a.i./A and NOAEC: 0.077 lbs a.i./A; vegetative vigor, lettuce – EC_{25}: 0.0056 lbs a.i./A and NOAEC: 0.0025 lbs a.i./A.

Due to the potential for direct effects to aquatic invertebrates, birds, mammals, and terrestrial plants from the current uses, indirect effects to aquatic invertebrates and fish may occur. Indirect effects may result from direct effects to a species that is important as a food item, in maintaining habitat, or in promoting dispersal, and pollination of another species. Aquatic invertebrates are an important food item for a number of species. Birds and mammals are important in seed dispersal and pollination of aquatic vascular plants. Therefore, indirect effects to all taxa may occur from the proposed uses.

4.2.C. Conclusion

Given the uses of acetamiprid and the chemical's environmental fate properties, there is a likelihood of exposure of acetamiprid ROC to non-target terrestrial and/or aquatic organisms. When used in accordance with the label, such exposure to acetamiprid may result in adverse effects upon the survival, growth, and reproduction of non-target terrestrial and aquatic organisms. Consistent with previous risk assessments (USEPA, 2015), there is a potential for direct adverse effects to freshwater and estuarine/marine invertebrates (especially benthic species), mammals, birds, terrestrial invertebrates, and terrestrial plants from exposure to acetamiprid as a result of registered uses.

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6. Registrant Submitted Studies List

MRID Study Title

63-9 Vapor Pressure

44651812 Gomyo, T.; Kobayashi, S. (1997) NI-25--Vapor Pressure: Amended Final Report: Lab Project Number: NISSO 2-79: EC-372-2: 2-79. Unpublished study prepared by Nisso Chemical Analysis Service Co., Ltd. 43 p.

63-10 Dissociation Constant

44651813 Gomyo, T.; Kobayashi, S. (1997) NI-25--Dissociation Constant in Water (pKa): Amended Final Report: Lab Project Number: NISSO 2-88: EC-371-2: 2-88. Unpublished study prepared by Nisso Chemical Analysis Service Co., Ltd. 30 p.

63-11 Oct/Water partition Coef.

44651814 Gomyo, T.; Kobayashi, S. (1997) NI-25--Octanol/Water Partition Coefficient: Amended Final Report: Lab Project Number: NISSO 2-84: EC-378-2: 2-84. Unpublished study prepared by Nisso Chemical Analysis Service Co., Ltd. 34 p.

71-1 Avian Single Dose Oral Toxicity

44651859 Johnson, A. (1994) NI-25: Acute Oral Toxicity (LD50) to the Mallard Duck: Lab Project Number: NPS 62/932516. Unpublished study prepared by Huntingdon Research Centre Ltd. 50 p.

71-2 Avian Dietary Toxicity

44651860 Johnson, A. (1994) NI-25: Subacute Dietary Toxicity (LC50) to the Bobwhite Quail: Lab Project Number: NPS 59/932525. Unpublished study prepared by Huntingdon Research Centre Ltd. 37 p.

44651861 Johnson, A. (1994) NI-25: Subacute Dietary Toxicity (LC50) to the Mallard Duck: Lab Project Number: NPS 60/942075. Unpublished study prepared by Huntingdon Research Centre Ltd. 40 p.

44651862 Brewer, L.; Taliaferro, M.; Miller, V. (1998) 5-Day Dietary Toxicity Test with IM-1-4 in the Mallard Duck (Anas platyrhynchos): Amended Final Report: Lab Project Number: 019803: EBA-019803. Unpublished study prepared by EBA, Inc. 166 p.

48844901 Ito, M. (2012) Acetamiprid Technical Grade: Dietary Toxicity Test in Zebra Finch (Poephila guttata). Project Number: 11/151. Unpublished study prepared by Research Inst. for Animal Science in Biochemistry and Toxicology. 45p.

71-4 Avian Reproduction

44988407 Taliaferro, M.; Brewer, L.; Miller, V. (1999) Reproduction Study with Acetamiprid in the Northern Bobwhite (Colinus virginianus): Amended Final Report: Lab Project Number: 029604. Unpublished study prepared by EBA, Inc. 319 p.

44988408 Taliaferro, M.; Miller, V. (1999) Reproduction Study with Acetamiprid in the Mallard Duck (Anas platyrhynchos): Final Report: Lab Project Number: 29708. Unpublished study prepared by EBA, Inc. 346 p.

46369201 Stafford, J. (2004) Acetamiprid (NI-25) - Reproductive Toxicity Test with Mallard Duck (Anas platyrhynchos). Project Number: 13798/4105. Unpublished study prepared by Springborn Smithers Laboratories. 153 p.

48825601 Stafford, J. (2012) Acetamiprid: Reproductive Toxicity Test with the Mallard Duck (Anas platyrhynchos). Project Number: 04182012/MALL. Unpublished study prepared by Smithers Viscient Laboratories. 16p.

72-1 Acute Toxicity to Freshwater Fish

44651863 Suteau, P. (1997) Acetamiprid: Acute Toxicity (96 Hours) to Bluegill (Lepomis macrochirus) Under Flow-Through Conditions: Amended Report: Lab Project Number: SA 96120: R&D/CRSA/ANL/96-011. Unpublished study prepared by Rhone-Poulenc Agrochimie. 72 p.

MRID	Study Title
44651864	Saika, O. (1996) NI-25--Acute Toxicity Study in Rainbow Trout: Lab Project Number: H088. Unpublished study prepared by Nippon Soda Co., Ltd. 23 p.
44651865	McElligott, A. (1998) IM-1-4: Acute Toxicity (96 Hours) to Rainbow Trout (Oncorhynchus mykiss) Under Semi-Static Conditions: Lab Project Number: SA 97231: R&D/CRSA/ANL/97-012. Unpublished study prepared by Rhone-Pulenc Agro. 82 p.
72-2	**Acute Toxicity to Freshwater Invertebrates**
44651866	Saika, O. (1997) NI-25: Acute Toxicity Study in Daphnids: Lab Project Number: H100. Unpublished study prepared by Nippon Soda Co., Inc. 22 p.
44651867	McElligott, A. (1997) IM-1-2: Acute Toxicity (48 Hours) to Daphnids (Daphnia magna) Under Semi-Static Conditions: Lab Project Number: SA 97046: R&D/CRSA/ANL/97-010. Unpublished study prepared by Rhone-Poulenc Agrochimie. 67 p.
44651868	McElligott, A. (1997) IM-1-4: Acute Toxicity (48 Hours) to Daphnids (Daphnia magna) Under Semi-Static Conditions: Lab Project Number: SA 97047: R&D/CRSA/ANL/97-012. Unpublished study prepared by Rhone-Poulenc Agrochimie. 67 p.
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44651869	Putt, A. (1998) Acetamiprid Technical--Acute Toxicity to Mysids (Mysidopsis bahia) Under Flow-Through Conditions: Final Report: Lab Project Number: 97-9-7100: 10566.0697.6424.515: 13529. Unpublished study prepared by Springborn Laboratories, Inc. 70 p.
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81-1	**Acute oral toxicity in rats**
44651821	Douds, D. (1997) An Acute Oral Toxicity Study in Rats with EXP 0667A: Amended Final Report: Lab Project Number: 3147.237. Unpublished study prepared by Springborn Laboratories, Inc. 69 p.

MRID	Study Title
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44651833	Mochizuki, N.; Kanaguchi, Y. (1998) Acetamiprid--Acute Oral Toxicity Study in Rats: Lab Project Number: G-0820. Unpublished study prepared by Nippon Soda Co., Ltd. 52 p.
44651834	Wakefield, A. (1998) IM-1-4: Acute Oral Toxicity Study in Rats: Amended Final Report: Lab Project Number: 6840-103: 18981-0-800: 22209. Unpublished study prepared by Covance Laboratories Inc. 36 p.
44651835	Mochizuki, N.; Goto, K. (1997) IM-1-2: Acute Oral Toxicity Study in Rats: Lab Project Number: G963. Unpublished study prepared by Nippon Soda Co., Ltd. 28 p.
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44651822	Douds, D. (1998) An Acute Dermal Toxicity Study in Rabbits with EXP 80667A: (Acetamiprid 70 WP): Final Report: Lab Project Number: 3147.238. Unpublished study prepared by Springborn Laboratories, Inc. 31 p.
44651828	Douds, D. (1998) An Acute Dermal Toxicity Study in Rabbits with NI-25 Plus Carbaryl RTU: Final Report: Lab Project Number: 3147.252. Unpublished study prepared by Springborn Laboratories, Inc. 30 p.
44651836	Mochizuki, N.; Fuji, Y. (1998) Acetamiprid: Acute Dermal Toxicity Study in Rats: Lab Project Number: G-0882. Unpublished study prepared by Nippon Soda Co., Ltd. 26 p.
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44651823	Bennick, J. (1997) NI-25 70% WP (EXP 80667A) Acute Inhalation Toxicity Study in Rats: Final Report: Lab Project Number: 3606-97. Unpublished study prepared by Stillmeadow, Inc. 20 p.
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44651837	Jackson, G. (1997) Acetamiprid: Acute (Four-Hour) Inhalation Study in Rats: Lab Project Number: NOD 4/970598. Unpublished study prepared by Huntingdon Life Sciences Ltd. 40 p.
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44651841	Hughes, E. (1997) Acetamiprid: Dose Range Finding Neurotoxicity to Rats by Acute Oral Administration (including determination of time to peak effect): Lab Project Number: RNP 510/970145. Unpublished study prepared by Huntingdon Life Sciences Ltd. 49 p.
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MRID	Study Title
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82-1	**Subchronic Oral Toxicity: 90-Day Study**
44651843	Nukui, T.; Ikeyama, S. (1997) Acetamiprid--Thirteen-Week Dietary Subchronic Toxicity Study in Rats: Lab Project Number: G-0768: 0246. Unpublished study prepared by Nippon Soda Co., Ltd. 376 p.
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44988425	Nukui, T.; Ikeyama, S. (1997) Acetamiprid*-Thirteen-Week Dietary Subchronic Toxicity Study in Mice: Lab Project Number: G-0769: 0249. Unpublished study prepared by Nippon Soda Co., Ltd. 341 p.
44988426	Ivett, J. (1999) 13-Week Dietary Subchronic Toxicity Study with IM-1-4 in Rats: Final Report: Lab Project Number: 6840-102. Unpublished study prepared by Covance Laboratories Inc. 353 p.
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45245306	Auletta, C. (1998) A 4-Week Oral Toxicity Study of NI-25 in the Dog via Dietary Administration (Acetamiprid Technical): Final Report. Unpublished study prepared by Bio-dynamics, Inc. 142 p.
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44651844	Trutter, J. (1997) 21-Day Dermal Toxicity Study in Rabbits with Acetamiprid: Final Report: Lab Project Number: 6224-236. Unpublished study prepared by Covance Laboratories Inc. 212 p.
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83-1	**Chronic Toxicity**
44651846	Auletta, C. (1998) A Chronic (12-Month) Oral Toxicity Study of NI-25 in the Dog via Dietary Administration: Final Report: Lab Project Number: 92-3117. Unpublished study prepared by Pharmaco LSR, Inc. 475 p.
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45245301	Cunny, H. (2000) Mean Pup Weights Per Liter (Male and Females Combined) for the Study, Two-Generation Reproduction Study with NI-25 Rats (Acetamiprid Technical): EPA MRID 44988430. Unpublished study prepared by Covance Laboratories, Inc. 15 p.
122-1	**Seed Germination/Seedline Emergence and Vegetable Vigor**
44988413	Teixiera, D. (1999) Acetamiprid--Determination of Effects on Seedling Emergence and Vegetative Vigor of Ten Plant Species: Final Report: Lab Project Number: 97-12-7184: 10566.0397.6416.610. Unpublished study prepared by Springborn Laboratories, Inc. 265 p.
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122-2	**Aquatic plant growth**
44988414	Hoberg, J. (1997) Acetamiprid Technical--Toxicity to the Freshwater Green Alga Selenastrum capricornutum: Final Report: Lab Project Number: 97-5-6987: 10566.0297.6410.430. Unpublished study prepared by Springborn Laboratories, Inc. 57 p.
44988415	Hoberg, J. (1997) Acetamiprid Technical--Toxicity to Duckweed, Lemna gibba: Final Report: Lab Project Number: 97-7-7029: 10566.0397.6415.410. Unpublished study prepared by Springborn Laboratories, Inc. 63 p.
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45323001	Willard, T. (2001) Acetamiprid: Dissipation of Dislodgeable Residue on Cotton: Final Study Report: Lab Project Number: 97512640. Unpublished study prepared by Aventis CropScience. 371 p. (OPPTS 875.2100)
141-1	**Honey bee acute contact**
44651874	Candolfi, M. (1997) NI-25 (Acetamiprid): Laboratory Oral and Contact Toxicity Test with the Honeybee, Apis mellifera: Lab Project Number: 96-045-1013: 1013.018.265: 3.5.96/BEE NI-25. Unpublished study prepared by Springborn Laboratories (Europe) AG. 50 p.
45932503	Kling, A. (2003) Acute Contact and Oral Toxicity of EXP 60707A to the Bumble-Bee Bombus terrestris L. Under Laboratory Conditions: (Final Report): Lab Project Number: 20021073/02-BLEU: EXP 60707 A. Unpublished study prepared by GAB Biotechnologie GmbH. 33 p.
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44651875	Collins, M. (1998) Evaluation of Toxicity of Residues of Acetamiprid (NI-25) on Alfalfa to Honey Bees (Apis mellifera): Final Report: Lab Project Number: 98-1-7214: 10566.0897.6449.266: 1412-97-004-09-21F-01. Unpublished study prepared by Landis International, Inc. and Springborn Laboratories, Inc. 80 p.
45346901	Hoberg, J. (2001) Evaluation of Toxicity of Residues of Acetamiprid (NI-25) and Procure 50WS on Alfalfa to Honey Bees (Apis mellifera): Lab Project Number: 13726.6123: 041100. Unpublished study prepared by Springborn Labs., Inc. 40 p. (OPPTS 850.3030)
45932502	Saika, O. (2003) Acetamiprid: Toxicity of Foliar Residue to Honey Bees: Lab Project Number: RD-03115. Unpublished study prepared by Nippon Soda Co., Ltd. 14 p.

141-5 Field test for pollinators

45932504	Schur, A. (2002) A Semi-Field Study on the Effects on Honey Bees (Apis mellifera L.) of Assail 70 WP (EXP61842A, Acetamiprid 70%) Straight and in Combination with the Fungicide Procure 50WS (Triflumizole 50%): (Final Report): Lab Project Number: 20011239/S1-BZEU: EXP61842A. Unpublished study prepared by GAB Biotechnologie GmbH. 54 p.
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44651876	Gomyo, T.; Kobayashi, S. (1997) NI-25--Hydrolysis: Amended Final Report: Lab Project Number: NISSO 2-89: EC-375-2: 2-89. Unpublished study prepared by Nisso Chemical Analysis Service Co., Ltd. 126 p.
44651877	Class, T. (1997) Hydrolysis of IM-1-4 and IC-0 (Two Degradates of Acetamiprid) as a Function of pH: Lab Project Number: P 225 G: B 225 G: 97-32. Unpublished study prepared by PTRL Europe. 24 p.

161-2 Photodegradation-water

44988509	Hausmann, S.; Class, T. (1998) Aqueous Photodegradation of (carbon-14)-Acetamiprid at pH 7 and Determination of Quantum Yield: Lab Project Number: P196G: B196G: 96-82. Unpublished study prepared by PTRL, West PTRL, Europe. 124 p.
44988510	Emeric, G. (1998) Acetamiprid--Verification of the Identity of the Photolyte Obtained at pH 7--Study: Lab Project Number: 98-47. Unpublished study prepared by Rhone-Poulenc Agro. 36 p.
44988511	Mamouni, A. (1997) Aqueous Photolysis of (carbon-14)-IM-1-4 Under Laboratory Conditions: Lab Project Number: 671332: 97-166. Unpublished study prepared by RCC Umweltchemie. 64 p.

161-3 Photodegradation-soil

44988508	Mislankar, S. (1998) Acetamiprid (NI-25) Soil Photolysis: Lab Project Number: EC-97-359: F97125-806: EC-97-359-HP. Unpublished study prepared by Rhone-Poulenc Ag Company. 149 p.

162-1 Aerobic soil metabolism

44651879	Feung, C. (1998) Acetamiprid (NI-25): Aerobic Soil Metabolism: Lab Project Number: EC-96-351. Unpublished study prepared by Rhone-Poulenc Ag Company. 122 p.
44651880	Feung, C. (1998) Acetamiprid (NI-25): Metabolism in Collombey Soil: Lab Project Number: EC-97-406. Unpublished study prepared by Rhone-Poulenc Ag Company. 78 p.
44651881	Burr, C. (1997) (Carbon 14)-NI-25: Rate of Aerobic Degradation in Three Soil Types at 20 (degrees Centigrade) and One Soil Type at 10 (degrees Centigrade): Lab Project Number: 11256: 201445. Unpublished study prepared by Rhone-Poulenc Agriculture Limited. 213 p.

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44699101	Morgenroth, U. (1997) (Carbon 14)-NI-25: Metabolism in One Soil Incubated Under Aerobic Conditions: Lab Project Number: 373994. Unpublished study prepared by RCC Umweltchemie AG. 125 p.

162-3 Anaerobic aquatic metab.

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44988513	Andrawes, N. (1999) Acetamiprid (NI-25): Aerobic Aquatic Metabolism: Lab Project Number: EC-96-352. Unpublished study prepared by Rhone-Poulenc Ag Co. 143 p.

163-1 Leach/adsorp/desorption

44651883	Liu, A. (1997) Acetamiprid (NI-25): Soil Adsorption/Desorption Study: Lab Project Number: EC-97-381: F97525-001: RP397ACL. Unpublished study prepared by Rhone-Poulenc Ag Company. 180 p.
44651884	Liu, A. (1997) 6-Chloronicotinic Acid (Acetamiprid Metabolite): Soil Adsorption/Desorption Study: Lab Project Number: EC-97-370: F97525-001: RP397ACL. Unpublished study prepared by Rhone-Poulenc Ag Company. 195 p.
44651885	Liu, A. (1998) (Carbon 14)-N-methyl-(6-chloro-3-pyridyl)- methylamine IM-1-4 (Acetamiprid Metabolite): Soil Adsorption/Desorption Study: Lab Project Number: EC-97-382: F97525-001: RP397ACL. Unpublished study prepared by Rhone-Poulenc Ag Company. 168 p.
44651886	Morgenroth, U. (1997) (Carbon 14)-NI-25: Leaching Characteristics of Aged Residues in One Soil: Lab Project Number: 374005. Unpublished study prepared by RCC Umweltchemie Ag. 95 p.
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44988515	Norris, F. (1999) Acetamiprid: Terrestrial Soil Dissipation of Acetamiprid (EXP 80667A) Under Agricultural Field Conditions Crops: Lab Project Number: 45753: 975126643: 12643-06. Unpublished study prepared by Rhone-Poulenc Ag Co. and ACDS Research, Inc. 788 p.
44988516	Yang, J. (1999) Method Validation Report for Acetamiprid (NI-25): Performance Summary of Methods of Analysis for NI-25 and its Metabolites IC-0, IM-1-4, and IM-1-2 in US Soil Using LC/MS/MS: Lab Project Number: 45841: 45453: 9752643. Unpublished study prepared by Rhone-Poulenc Ag Co. 572 p. (OPPTS 850.7100)
44988517	Zheng, S. (1999) Independent Laboratory Validation of Analytical Methods NI-25: Method of Analysis and its Metabolite, IC-0, Using LC/MS/MS; NI-25: Methods of Analysis for IM-1-2 a Metabolite of NI-25 in Soil Using LC/MS/MS; and NI-25: Method of Analysis for IM-1-4, a Metabolite of NI-25, in Soil Using LC/MS/MS: Lab Project Number: 019-016: 98P-019-016: EC-98-447. Unpublished study prepared by Centre Analytical Labs., Inc. 152 p. (OPPTS 850.7100)
44988625	Cosgrove, D. (1999) A Terrestrial Field Dissipation Study with Acetamiprid, Canada, 1999: Final Study Report: Lab Project Number: 99086DC: 99001: 99002. Unpublished study prepared by Enviro-Test Lab., Inc. 388 p.

171-4C Magnitude of the Residue [by commodity]

MRID	Study Title
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44988603	Carringer, S. (1999) Acetamiprid: Magnitude of Residues in Leafy Lettuce: Final Report: Lab Project Number: 97512110: 97512110-07: 97512110-06. Unpublished study prepared by Enviro-Bio-Tech., Ltd. and Plant Sciences., Inc. 238 p. (OPPTS 860.1500)
44988604	Carringer, S. (1999) Acetamiprid: Magnitude of Residues in Spinach: Final Report: Lab Project Number: 95712111-10: 97512111-09: 97512111-08. Unpublished study prepared by Enviro-Bio-Tech., Ltd. and Plant Sciences., Inc. 229 p. (OPPTS 860.1500)
44988605	Carringer, S. (1999) Acetamiprid: Magnitude of Residues in Head Lettuce: Final Report: Lab Project Number: 97512109-02: 97512109: 97512109-04. Unpublished study prepared by Enviro-Bio-Tech., Ltd. and Plant Sciences., Inc. 250 p. (OPPTS 860.1500)
44988606	Carringer, S. (1999) Acetamiprid: Magnitude of Residues in Celery: Final Report: Lab Project Number: 97512112: 97512112-09: 97512112-10. Unpublished study prepared by Enviro-Bio-Tech., Ltd. and Plant Sciences., Inc. 238 p. (OPPTS 860.1500)
44988607	Mester, T.; Felix, K. (1999) Acetamiprid: Magnitude of Residues in/on Broccoli Resulting from Foliar Applications of EXP80667A (1997): Final Report: Lab Project Number: 97512645: 98753B: RP-01-98. Unpublished study prepared by Enviro-Bio-Tech., Ltd. and ABC Labs., Inc. 222 p. (OPPTS 860.1500)
44988608	Mester, T.; Fischer, E. (1999) Acetamiprid: Magnitude of Residues in/on Cabbage Resulting from Foliar Applications of EXP80667A (1997): Final Report: Lab Project Number: 97512646: 98753C: RP-02-98. Unpublished study prepared by Enviro-Bio-Tech., Ltd. and ABC Labs., Inc. 254 p. (OPPTS 860.1500)
44988609	Mester, T.; Felix, K.; Benson, A. (1999) Acetamiprid: Magnitude of Residues in/on Mustard Greens Resulting from Foliar Applications of EXP80667A (1997): Final Report: Lab Project Number: 97512647: 98753D: RP-03-98. Unpublished study prepared by Enviro-Bio-Tech., Ltd. and ABC Labs., Inc. 230 p. (OPPTS 860.1500)
44988610	Macy, L. (1999) NI-25: Magnitude of Acetamiprid Residues in/on Cottonseed and Gin Trash: Final Report: Lab Project Number: 12104-08: 12104-07: 12104-06. Unpublished study prepared by Stoneville R&D, Inc. and Mid-South Ag Research, Inc. 433 p.
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44988618	Macy, L. (1999) NI-25: Magnitude of Acetamiprid Residues in/on Cottonseed, Gin Trash, Cotton Meal, Hulls, and Refined Oil: Final Study Report: Lab Project Number: 97512105: 45835: 12105-01. Unpublished study prepared by Rhone-Poulenc Ag Co. 270 p. (OPPTS 860.1520)
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44988633	Cosgrove, D. (1999) Acetamiprid: Magnitude of Residues in Spinach, Canada, 1999: Final Study Report: Lab Project Number: 999064DC: 99036: 99037. Unpublished study prepared by Enviro-Test Lab., Inc. 168 p.
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830.7050	**UV/Visible absorption**
49590803	Xu, J. (2015) Physical and Chemical Characterization of Acetamiprid TGAI: Color, Physical State, Odor, Stability, Oxidation/Reduction, pH, UV/Visible Absorption, Melting Point and Density: Final Report. Project Number: ABC/2015/02. Unpublished study prepared by Achiever Biochem Company Limited GLP Lab. 90p.
49693403	Kellogg, M. (2015) Waiver Request for Certain Data Requirements for A102.3 Acetamiprid 8.5 SL. Project Number: SYN/201502. Unpublished study prepared by SynTelus, LLC. 7p.
49707403	Kellogg, M. (2015) Waiver Request for Certain Data Requirements for A102.2 Acetamiprid 30 SG. Project Number: SYN/201503. Unpublished study prepared by SynTelus, LLC. 7p.
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49937002	Leapard, J. (2015) Physical and Chemical Characteristics of Acetamiprid Technical: Final Report. Project Number: ARC/EX/1597, ARC/EX/1597/013/P/1. Unpublished study prepared by Analytical & Regulatory Chemistry, Inc. 49p.
830.7370	**Dissociation constants in water**
46255602	Takashima, K. (2002) Dissociation Constant of IM-1-5. Project Number: NCAS/02/132. Unpublished study prepared by Nisso Chemical Analysis Service Co., Ltd. 18 p.
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49707403	Kellogg, M. (2015) Waiver Request for Certain Data Requirements for A102.2 Acetamiprid 30 SG. Project Number: SYN/201503. Unpublished study prepared by SynTelus, LLC. 7p.
49866003	Kellogg, M. (2016) Waiver Request for Certain Data Requirements for ArVida 30 SG Insecticide. Project Number: ATT/201603. Unpublished study prepared by Atticus, LLC. 7p.
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830.7550	**Partition coefficient (n-octanol/water), shake flask method**
49590804	Tillman, A. (2015) Argite Acetamiprid Technical: Physical and Chemical Properties and Waiver Request. Project Number: ARG/201502. Unpublished study prepared by Argite TGAI, LLC. 16p.
49691304	Kellogg, M. (2015) Waiver Request for Certain Data Requirements for A 102.1 Acetamiprid 70 WP. Project Number: AR/201502. Unpublished study prepared by Argite, LLC. 7p.
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830.7560	**Partition coefficient (n-octanol/water), generator column method**
49590804	Tillman, A. (2015) Argite Acetamiprid Technical: Physical and Chemical Properties and Waiver Request. Project Number: ARG/201502. Unpublished study prepared by Argite TGAI, LLC. 16p.
49691304	Kellogg, M. (2015) Waiver Request for Certain Data Requirements for A 102.1 Acetamiprid 70 WP. Project Number: AR/201502. Unpublished study prepared by Argite, LLC. 7p.
49693403	Kellogg, M. (2015) Waiver Request for Certain Data Requirements for A102.3 Acetamiprid 8.5 SL. Project Number: SYN/201502. Unpublished study prepared by SynTelus, LLC. 7p.
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49866203	Kellogg, M. (2016) Waiver Request for Certain Data Requirements for RaVida 8.5 SL Insecticide. Project Number: ATT/201606. Unpublished study prepared by Atticus, LLC. 7p.
830.7570	**Partition coefficient (n-octanol/water), estimation by liquid chromatography**
49590804	Tillman, A. (2015) Argite Acetamiprid Technical: Physical and Chemical Properties and Waiver Request. Project Number: ARG/201502. Unpublished study prepared by Argite TGAI, LLC. 16p.
49691304	Kellogg, M. (2015) Waiver Request for Certain Data Requirements for A 102.1 Acetamiprid 70 WP. Project Number: AR/201502. Unpublished study prepared by Argite, LLC. 7p.
49693403	Kellogg, M. (2015) Waiver Request for Certain Data Requirements for A102.3 Acetamiprid 8.5 SL. Project Number: SYN/201502. Unpublished study prepared by SynTelus, LLC. 7p.
49707403	Kellogg, M. (2015) Waiver Request for Certain Data Requirements for A102.2 Acetamiprid 30 SG. Project Number: SYN/201503. Unpublished study prepared by SynTelus, LLC. 7p.
49866003	Kellogg, M. (2016) Waiver Request for Certain Data Requirements for ArVida 30 SG Insecticide. Project Number: ATT/201603. Unpublished study prepared by Atticus, LLC. 7p.

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49866103	Kellogg, M. (2016) Waiver Request for Certain Data Requirements for ArVida 70 WP Insecticide. Project Number: ATT/201605. Unpublished study prepared by Atticus, LLC. 7p.
49866203	Kellogg, M. (2016) Waiver Request for Certain Data Requirements for RaVida 8.5 SL Insecticide. Project Number: ATT/201606. Unpublished study prepared by Atticus, LLC. 7p.
830.7840	**Water solubility: Column elution method, shake flask method**
49590804	Tillman, A. (2015) Argite Acetamiprid Technical: Physical and Chemical Properties and Waiver Request. Project Number: ARG/201502. Unpublished study prepared by Argite TGAI, LLC. 16p.
49693403	Kellogg, M. (2015) Waiver Request for Certain Data Requirements for A102.3 Acetamiprid 8.5 SL. Project Number: SYN/201502. Unpublished study prepared by SynTelus, LLC. 7p.
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49866003	Kellogg, M. (2016) Waiver Request for Certain Data Requirements for ArVida 30 SG Insecticide. Project Number: ATT/201603. Unpublished study prepared by Atticus, LLC. 7p.
49866103	Kellogg, M. (2016) Waiver Request for Certain Data Requirements for ArVida 70 WP Insecticide. Project Number: ATT/201605. Unpublished study prepared by Atticus, LLC. 7p.
49866203	Kellogg, M. (2016) Waiver Request for Certain Data Requirements for RaVida 8.5 SL Insecticide. Project Number: ATT/201606. Unpublished study prepared by Atticus, LLC. 7p.
830.7860	**Water solubility, generator column method**
49590804	Tillman, A. (2015) Argite Acetamiprid Technical: Physical and Chemical Properties and Waiver Request. Project Number: ARG/201502. Unpublished study prepared by Argite TGAI, LLC. 16p.
49693403	Kellogg, M. (2015) Waiver Request for Certain Data Requirements for A102.3 Acetamiprid 8.5 SL. Project Number: SYN/201502. Unpublished study prepared by SynTelus, LLC. 7p.
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49866103	Kellogg, M. (2016) Waiver Request for Certain Data Requirements for ArVida 70 WP Insecticide. Project Number: ATT/201605. Unpublished study prepared by Atticus, LLC. 7p.
49866203	Kellogg, M. (2016) Waiver Request for Certain Data Requirements for RaVida 8.5 SL Insecticide. Project Number: ATT/201606. Unpublished study prepared by Atticus, LLC. 7p.
830.7950	**Vapor pressure**
49590804	Tillman, A. (2015) Argite Acetamiprid Technical: Physical and Chemical Properties and Waiver Request. Project Number: ARG/201502. Unpublished study prepared by Argite TGAI, LLC. 16p.
49693403	Kellogg, M. (2015) Waiver Request for Certain Data Requirements for A102.3 Acetamiprid 8.5 SL. Project Number: SYN/201502. Unpublished study prepared by SynTelus, LLC. 7p.
49707403	Kellogg, M. (2015) Waiver Request for Certain Data Requirements for A102.2 Acetamiprid 30 SG. Project Number: SYN/201503. Unpublished study prepared by SynTelus, LLC. 7p.
49866003	Kellogg, M. (2016) Waiver Request for Certain Data Requirements for ArVida 30 SG Insecticide. Project Number: ATT/201603. Unpublished study prepared by Atticus, LLC. 7p.

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49866103	Kellogg, M. (2016) Waiver Request for Certain Data Requirements for ArVida 70 WP Insecticide. Project Number: ATT/201605. Unpublished study prepared by Atticus, LLC. 7p.
49866203	Kellogg, M. (2016) Waiver Request for Certain Data Requirements for RaVida 8.5 SL Insecticide. Project Number: ATT/201606. Unpublished study prepared by Atticus, LLC. 7p.
835.1240	**Soil column leaching**
49734001	Schick, M. (2015) Leaching of (Carbon 14) Acetamiprid in Soil Columns Treated with Technical Grade Active Ingredient and F5688 11% ME Insecticide Termiticide. Project Number: 2481W/1, 2481W. Unpublished study prepared by PTRL West, Inc. 188p.
835.2410	**Photodegradation of parent and degradates in soil**
48563501	Sugiyama, K. (2011) Photodegradation of [(Carbon 14)] Acetamiprid on Soil by Artificial Sunlight. Project Number: 2126W. Unpublished study prepared by PTRL West, Inc. 235p.
48979901	Wrubel, J. (2012) Response to EPA Reviews of an Anaerobic Soil Metabolism Study (MRID 48554501) and a Soil Photolysis Study (MRID 48563501) with Acetamiprid. Project Number: NAI/12/003. Unpublished study prepared by Nippon Soda Co., Ltd. 11p.
835.4100	**Aerobic soil metabolism**
46255603	Simmonds, M. (2002) (Carbon 14)-Acetamiprid: Rate of Degradation in Three Calcareous Soils at 20 (Degrees) C. Project Number: CX/01/013. Unpublished study prepared by Battelle Agrifood, Ltd. 198 p.
49734002	Schick, M. (2015) Aerobic Soil Metabolism of (Carbon 14) Acetamiprid in Four Soils. Project Number: 2482W, 2482W/1. Unpublished study prepared by PTRL West, Inc. 184p.
835.4200	**Anaerobic soil metabolism**
48554501	Hiler, T. (2011) (Acetamiprid Technical): Anaerobic Soil Metabolism of Carbon 14 Acetamiprid on Two Soil Types. Project Number: 2105W, 2111W. Unpublished study prepared by PTRL West, Inc. 170p.
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835.4300	**Aerobic aquatic metabolism**
49034201	McMillan-Statf, S.; Austin, D. (1997) [(Carbon 14)] - NI-25 Degradation in Two Water/Sediment Systems (Acetamiprid Technical). Project Number: 11263. Unpublished study prepared by Rhone-Poulenc Agriculture, Ltd. 193p.
49734003	Hiler, T. (2015) Aerobic Aquatic Metabolism of (Carbon 14) Acetamiprid in Two Sediment/Water Systems. Project Number: 2483W, 2483W/1. Unpublished study prepared by PTRL West, Inc. 273p.
835.4400	**Anaerobic aquatic metabolism**
49734004	Hiler, T. (2015) Anaerobic Aqautic Metabolism of (Carbon 14) Acetamiprid in Two Sediment/Water Systems. Project Number: 2484W, 2484W/1. Unpublished study prepared by PTRL West, Inc. 164p.
850.1010	**Aquatic invertebrate acute toxicity, test, freshwater daphnids**
46255608	Saito, S. (2002) IM-1-5 (N-((6-Chloro-3-Pyridyl) methyl)-N-Methylacetamidine): Acute Toxicity to Daphnia magna. Project Number: NCAS/02/197. Unpublished study prepared by Nisso Chemical Analysis Service Co., Ltd. 23 p.
49034202	Saika, O. (1995) NI-25 70% WP: Acute Toxicity Study in Daphnids (Acetamiprid Technical). Project Number: H057. Unpublished study prepared by Nippon Soda Co., Ltd. 20p.
850.1400	**Fish early-life stage toxicity test**

MRID	Study Title
46729101	Saika, O. (2005) Response to Data Evaluation Report on the Toxicity of Acetamiprid (NI-25) to Fathead Minnow (Pimephales promelas), Fish Early Life Cycle (MRID 44651872). Project Number: NAI/06/002, SA/96123. Unpublished study prepared by Nippon Soda Co., Ltd. 83 p.
850.2100	**Avian acute oral toxicity test**
48407701	Hubbard, P. (2011) Acetamiprid: An Acute Oral Toxicity Study with the Zebra Finch (Poephila guttata). Project Number: 437/119. Unpublished study prepared by Wildlife International, Ltd. 76 p.
850.2300	**Avian reproduction test**
46014801	Brewer, L.; Bowers, L. (2003) Reply to EPA Data Evaluation Record (DER) for a Northern Bobwhite Reproduction Study with Acetamiprid. Project Number: NAI/03/001. Unpublished study prepared by Springborn Smithers Laboratories.
46369201	Stafford, J. (2004) Acetamiprid (NI-25) - Reproductive Toxicity Test with Mallard Duck (Anas platyrhynchos). Project Number: 13798/4105. Unpublished study prepared by Springborn Smithers Laboratories. 153 p.
46555601	Temple, D.; Martin, K.; Beavers, J.; et. al. (2005) Acetamiprid: A Reproductive Study with the Northern Bobwhite. Project Number: 437/104. Unpublished study prepared by Wildlife International, Ltd. 186 p.
46717701	Brewer, L. (2005) Response to EPA DER for Acetamiprid (NI-25) - Reproductive Toxicity Test with Mallard Duck (Anas platyrhynchos). Project Number: NAI/05/001. Unpublished study prepared by Springborn Smithers Laboratories. 17 p.
49342202	Stafford, J. (2014) Acetamiprid: Reproductive Toxicity Test with Mallard Duck (Anas platyrhynchos). Project Number: 12681/4105, 04182012/MALL, 12681/4106. Unpublished study prepared by Smithers Viscient. 377p.
850.3030	**Honey bee toxicity of residues on foliage**
47737801	Walsh, D. (2009) Pollinator Pesticide Safety Trials 2007: Flonicamid. Project Number: IB/2009/PH/002/01. Unpublished study prepared by Washington State University. 19 p.
850.3040	**Field testing for pollinators**
49342201	Bocksch, S. (2013) Assessment of Side Effects of Acetamiprid 20 SG on the Honeybee (Apis mellifer L.) in the Semi-Field After Two Applications in Phacelia tanacetifolia in Germany 2012. Project Number: S12/02219, S11/01133. Unpublished study prepared by Eurofins Agroscience Services EcoChem GmbH. 178p.
850.4100	**Terrestrial plant toxicity, Tier 1 (seeding emergence)**
49356501	Sindermann, A.; Swerida, R.; Porch, J.; et al. (2014) Assail 70WP: A Toxicity Test to Determine the Effects of the Test Substance on Seedling Emergence of Ten Species of Plants. Project Number: 437P/102, 437/121013/SEEDEM/10/OCSPP/SUB437. Unpublished study prepared by Wildlife International, Ltd. 121p.
47716901	Leonard, R. (2008) Acetamiprid: Magnitude of the Residue on Red Clover (Grown for Seed Only). Project Number: 09600, 09600/06/MIR02, 09600/06/OR08. Unpublished study prepared by Interregional Research Project No. 4, IR-4 North Central Analytical Lab and Oregon State University. 167 p.
47716902	Samoil, K. (2007) Acetamiprid: Magnitude of the Residue on Grape. Project Number: 09057, 09057/05/MIR13, 09057/05/BC01. Unpublished study prepared by Interregional Research Project No. 4, Agriculture & Agri-Food Canada, and Attaway Field Research. 212 p.
47716903	Samoil, K. (2004) Acetamiprid: Magnitude of the Residue on Tomato (Greenhouse): Amended Report. Project Number: 08354, 08354/02/NYR19, 08354/02/TN15. Unpublished study prepared by Interregional Research Project No. 4, University of Tennessee and Texas A&M University, Texas Agric. 155 p.
47781201	Samoil, K. (2009) Summary Report of Magnitude of the Residue Research of Acetamiprid on Tea (Amended Report). Project Number: 10316. Unpublished study prepared by Interregional Research Project No. 4. 34 p.

MRID	Study Title
870.1100	**Acute oral toxicity**
46271906	Li, K. (2004) Acetamiprid (F5025) Ant & Roach Baits: Acute Oral Toxicity (in Rats) Studies and Waiver Request for Acute Dermal and Inhalation Toxicity, Eye and Skin Irritation and Skin Sensitization Studies. Project Number: P/3680, 3223/30, A2003/5722. Unpublished study prepared by FMC Corp Agricultural Products Group and Charles River Laboratories, Inc. 109 p.
46342702	Allen, D. (1997) NI-25 WSG: Acute Oral Toxicity Test in the Rat. Project Number: 235/148. Unpublished study prepared by Safepharm Laboratories, Ltd. 32 p.
46432802	Cerven, D. (2004) F4688: Acute Oral Toxicity (In Rats) - Up and Down Procedure (UDP). Project Number: A2004/5837, 1010/01, MB/04/12712/01. Unpublished study prepared by MB Research Laboratories. 24 p.
46685502	Patterson, D. (2001) An Acute Oral Toxicity Study in Rats with Acetamiprid 50 SF (EXP 81141A). Project Number: 3522/19. Unpublished study prepared by Springborn Laboratories, Inc. (SLI). 65 p.
46794304	Rodabaugh, D. (2006) An Acute Oral Toxicity Study in Rats with Acetamiprid 0.075% Ant Bait (Up/Down Study Design). Project Number: KZH00078, 000TSC05512, A2005/5953. Unpublished study prepared by Charles River Laboratories, Inc. 45 p.
46794306	Nuber, D. (2006) Acetamiprid Gel Baits (0.35% and 0.075%) Waiver Request for Acute Inhalation Toxicity. Project Number: P/3813. Unpublished study prepared by FMC Corp. 18 p.
46860202	Oshio, I. (2005) Acute Oral Toxicity Study of Acetamiprid 9.25 SL in Rats. Project Number: H262. Unpublished study prepared by Nippon Soda Co., Ltd. 24 p.
46860203	Takaori, H. (2006) Acute Oral Toxicity Study of Acetamiprid 9.25 SL in Rats - Second Study. Project Number: H285. Unpublished study prepared by Nippon Soda Co., Ltd. 20 p.
47838505	Griffon, B. (2001) Acetamiprid CEL 26521 SL: Acute Oral Toxicity in Rats. Project Number: 22016/TAR, 22016/TAR/CEL/265/21/SL/SCOTTS/FRANCE/SAS. Unpublished study prepared by Centre International de Toxicologie. 24 p.
47848104	Griffon, B. (2003) UKSO48A: Acute Oral Toxicity in Rats: "Acute Toxicity Class Method". Project Number: 25496/TAR. Unpublished study prepared by Centre International de Toxicologie. 27 p.
47868802	Rodabaugh, D. (2009) An Acute Oral Toxicity Study in Rats with EQEF 303 F5688 Insecticide (Up/Down Study Design). Project Number: KZH00123, A2006/6091. Unpublished study prepared by Charles River Laboratories, Inc. 55 p.
48327303	Wrubel, J. (2010) F7180-8 Fly Sticker Insecticide: Request for Bridging of Acute Toxicity Data Requirements. Project Number: NAI/10/004. Unpublished study prepared by Nisso America, Inc. 5 p.
48404404	Durando, J. (2011) GWN-9857: Acute Oral Toxicity Up and Down Procedure in Rats. Project Number: 29853, P320/UDP. Unpublished study prepared by Eurofins/Product Safety Laboratories. 20 p.
48463104	Durando, J. (2011) RF2157 Bait: Acute Oral Toxicity Up and Down Procedure in Rats. Project Number: 30975, P320/UDP/WEL. Unpublished study prepared by Eurofins/Product Safety Laboratories. 16 p.
48584601	Wolf, T. (2011) "AMP 44 RB": Acute Oral Toxicity Study with Rats (Up-and-Down Procedure). Project Number: KW173. Unpublished study prepared by Seibersdorf Labor GmbH. 31p.
49468204	Reddy, V. (2014) Acute Oral Toxicity Study of Lot 507-207 in Sprague Dawley Rats. Project Number: 4518, VLL/0913/G/T054/R, 11443/13/VLL/000/01. Unpublished study prepared by Vimta Labs Limtied. 44p.
49468208	Mizens, M. (2014) RF2213 AE CDSO: Request for Data Bridging for Pesticide Data Requirements. Project Number: 4638, 4464, VLL/0913/G/T056. Unpublished study prepared by Central Garden & Pep Company. 17p.
49468209	Cordel, C. (2013) Safetey Evaluation of Lot 507-207 in Adult Dogs. Project Number: 4464. Unpublished study prepared by Clin Vet International. 627p.

MRID	**Study Title**
49468210	Mizens, M. (2014) RF2213 AE CDSO: Summary of Acute Toxicity and Companion Animal Safety Data Bridging from Experimental Formula Lot 507-207. Project Number: NAI/14/001, 4518, 4519. Unpublished study prepared by Central Garden & Pet Company. 9p.
49709804	Haferkorn, J. (2013) Acute Oral Toxicity Study of MCW-4049 in Rats. Project Number: 29730, R/31311. Unpublished study prepared by LPT Laboratory of Pharmacology and Toxicology GmbH & Company KG. 30p.
50173004	Durando, J. (2016) HM-1570: Acute Oral Toxicity - Up-And-Down Procedure in Rats. Project Number: 44154, P320/UDP. Unpublished study prepared by Product Safety Laboratories. 16p.
50211205	Durando, J. (2016) RF2240 Concentrate: Acute Oral Toxicity - Up-And-Down Procedure in Rats. Project Number: 43028, P320/UDP/WEL, 5060. Unpublished study prepared by Product Safety Laboratories. 16p.
50260610	Hadiya, K. (2017) Final Report: Acute Oral Toxicity Study of Acetamiprid 150 + Methoxyfenozide 240 WG in Rats. Project Number: 401/1/01/15016. Unpublished study prepared by Jai Research Foundation. 57p.
870.1200	**Acute dermal toxicity**
46342703	Allen, D. (1997) NI-25 WSG: Acute Dermal Toxicity (Limit Test) in the Rat. Project Number: 235/150. Unpublished study prepared by Safepharm Laboratories, Ltd. 18 p.
46432803	Gilotti, A. (2004) F4688: Acute Dermal Toxicity/LD50 in Rabbits. Project Number: A2004/5838, MB/04/12712/02, 1100/02. Unpublished study prepared by MB Research Laboratories. 25 p.
46685503	Patterson, D. (2001) An Acute Dermal Toxicity Study in Rabbits with Acetamiprid 50 SF (EXP81141A). Project Number: 3522/20. Unpublished study prepared by Springborn Laboratories, Inc. (SLI). 29 p.
46794305	Rodabaugh, D. (2006) An Acute Dermal Toxicity Study in Rats with Acetamiprid 0.075% Ant Bait. Project Number: KZH00079, A2005/5952, 000TSC05512. Unpublished study prepared by Charles River Laboratories, Inc. 53 p.
46794306	Nuber, D. (2006) Acetamiprid Gel Baits (0.35% and 0.075%) Waiver Request for Acute Inhalation Toxicity. Project Number: P/3813. Unpublished study prepared by FMC Corp. 18 p.
46860204	Sanders, A. (2006) Acetamprid 9.25 SL: Acute Dermal Toxicity (Limit Test) in the Rat. Project Number: 235/494R. Unpublished study prepared by Safepharm Laboratories Ltd. 19 p.
47838506	Griffon, B. (2001) CEL 26521 SL: Acute Dermal Toxicity in Rats. Project Number: 22017/TAR, 22017/TAR/CEL/265/21/SL/SCOTTS/FRANCE/SAS. Unpublished study prepared by Centre International de Toxicologie. 26 p.
47848105	Griffon, B. (2003) UKSO48A: Acute Dermal Toxicity in Rats. Project Number: 25497/TAR. Unpublished study prepared by Centre International de Toxicologie. 27 p.
47868803	Rodabaugh, D. (2009) An Acute Dermal Toxicity Study in Rats with EQEF 303 F5688 Insecticide. Project Number: KZH00133, A2006/6093. Unpublished study prepared by Charles River Laboratories, Inc. 56 p.
48327303	Wrubel, J. (2010) F7180-8 Fly Sticker Insecticide: Request for Bridging of Acute Toxicity Data Requirements. Project Number: NAI/10/004. Unpublished study prepared by Nisso America, Inc. 5 p.
48404405	Durando, J. (2010) GWN-9857: Acute Dermal Toxicity Study in Rats: Limit Test. Project Number: 29854, P322/RAT. Unpublished study prepared by Eurofins/Product Safety Laboratories. 15 p.
48463105	Durando, J. (2011) RF2157 Bait: Acute Dermal Toxicity Study in Rats. Project Number: P322/RAT/WEL, 30976. Unpublished study prepared by Eurofins/Product Safety Laboratories. 15 p.
49468205	Reddy, V. (2014) Acute Dermal Toxicity Study of Lot 507-207 in Sprague Dawley Rats. Project Number: 4519, VLL/0913/G/T055/R, 11443/13/VLL/000/01A. Unpublished study prepared by Vimta Labs Limited. 37p.

MRID	Study Title
49468208	Mizens, M. (2014) RF2213 AE CDSO: Request for Data Bridging for Pesticide Data Requirements. Project Number: 4638, 4464, VLL/0913/G/T056. Unpublished study prepared by Central Garden & Pep Company. 17p.
49468210	Mizens, M. (2014) RF2213 AE CDSO: Summary of Acute Toxicity and Companion Animal Safety Data Bridging from Experimental Formula Lot 507-207. Project Number: NAI/14/001, 4518, 4519. Unpublished study prepared by Central Garden & Pet Company. 9p.
49709807	Haferkorn, J. (2013) Acute Dermal Toxicity Study of MCW-4049 in Rats. Project Number: 29731, R/31312. Unpublished study prepared by LPT Laboratory of Pharmacology and Toxicology GmbH & Company KG. 33p.
50173005	Durando, J. (2016) HM-1570: Acute Dermal Toxicity in Rats. Project Number: 44155, P322/RAT. Unpublished study prepared by Product Safety Laboratories. 15p.
50211206	Durando, J. (2016) RF2240 Concentrate: Acute Dermal Toxicity in Rats. Project Number: 43029, P322/RAT/WEL, 5061. Unpublished study prepared by Product Safety Laboratories. 16p.
50260611	Hadiya, K. (2016) Final Report: Acute Dermal Toxicity Study of Acetamiprid 150 + Methoxyfenozide 240 WG in Rats. Project Number: 403/1/01/15017. Unpublished study prepared by Jai Research Foundation. 39p.
870.1300	**Acute inhalation toxicity**
46432804	Gilotti, A. (2004) F4688: Acute Inhalation Toxicity/LC50 in Rats. Project Number: A2004/5840, 1300/02, MB/04/12712/05. Unpublished study prepared by MB Research Laboratories. 35 p.
46685504	Patterson, D. (2001) An Acute Nose-Only Inhalation Toxicity Study in Rats with Acetamiprid 50 SF (EXP 81141A). Project Number: 3522/24. Unpublished study prepared by Springborn Laboratories, Inc. (SLI). 53 p.
46794306	Nuber, D. (2006) Acetamiprid Gel Baits (0.35% and 0.075%) Waiver Request for Acute Inhalation Toxicity. Project Number: P/3813. Unpublished study prepared by FMC Corp. 18 p.
46860205	Griffiths, D. (2005) Acetamprid 9.25 SL: Acute Inhalation Toxicity (Nose Only) Study in the Rat. Project Number: 235/492R. Unpublished study prepared by Safepharm Laboratories Ltd. 37 p.
47838507	Restum, J. (2009) Acetamiprid Concentrate Insecticide Waiver Request from Further Testing: Acute Inhalation Toxicity LC50. Project Number: NAI/09/004. Unpublished study prepared by The Scotts Company. 6 p.
47848106	Restum, J (2009) Acetamiprid + Triticonazole Concentrate Insecticide and Fungicide: Waiver Request from Further Testing: Acute Inhalation Toxicicty LC50. Project Number: NAI/09/003. Unpublished study prepared by The Scotts Company. 6 p.
47868804	Rodabaugh, D. (2006) An Acute Nose-Only Inhalation Study in Rats with EQEF 303 F5688. Project Number: KZH00136, A2006/6092. Unpublished study prepared by Charles River Laboratories, Inc. 71 p.
48327303	Wrubel, J. (2010) F7180-8 Fly Sticker Insecticide: Request for Bridging of Acute Toxicity Data Requirements. Project Number: NAI/10/004. Unpublished study prepared by Nisso America, Inc. 5 p.
48404406	Durando, J. (2010) GWN-9857: Acute Inhalation Toxicity Study in Rats. Project Number: 29855, P330. Unpublished study prepared by Eurofins/Product Safety Laboratories. 24 p.
48463106	Mizens, M. (2011) RF2157 Bait: Request for Waiver of Tier 1 Pesticide Data Requirements. Project Number: 3948. Unpublished study prepared by Wellmark International. 16 p.
49468208	Mizens, M. (2014) RF2213 AE CDSO: Request for Data Bridging for Pesticide Data Requirements. Project Number: 4638, 4464, VLL/0913/G/T056. Unpublished study prepared by Central Garden & Pep Company. 17p.
49468210	Mizens, M. (2014) RF2213 AE CDSO: Summary of Acute Toxicity and Companion Animal Safety Data Bridging from Experimental Formula Lot 507-207. Project Number: NAI/14/001, 4518, 4519. Unpublished study prepared by Central Garden & Pet Company. 9p.

MRID	Study Title
49709808	Haferkorn, J. (2013) Acute Inhalation Toxicity Study of MCW-4049 in Rats. Project Number: 29732, R/31313. Unpublished study prepared by LPT Laboratory of Pharmacology and Toxicology GmbH & Company KG. 45p.
50173006	Durando, J. (2016) HM-1570: Acute Inhalation Toxicity in Rats. Project Number: 44156, P330. Unpublished study prepared by Product Safety Laboratories. 25p.
50211207	Durando, J. (2016) RF2240 Concentrate: Acute Inhalation Toxicity in Rats. Project Number: 43030, 5062, P330/WEL. Unpublished study prepared by Product Safety Laboratories. 26p.
50260612	Bhimani, V. (2016) Final Report: Acute Inhalation Toxicity Study of Acetamiprid 150 + Methoxyfenozide 240 WG in Rats. Project Number: 405/1/01/15018. Unpublished study prepared by Jai Research Foundation. 51p.
870.6300	**Developmental neurotoxicity study**
46255619	Nemec, M. (2003) An Oral Developmental Neurotoxicity Study of Acetamiprid in Rats. Project Number: WIL/21193. Unpublished study prepared by WIL Research Laboratories, Inc. 1643 p.
46779201	Nemec, M.; Beck, M.; Sloter, E. (2006) Rebuttal of Data Evaluation Record for Acetamiprid (WIL No. 21193, EPA Acetamiprid 099050, MRID 46255619). Project Number: NAI/06/004, WIL/21193B. Unpublished study prepared by WIL Research Laboratories, Inc. 313 p.
46779202	Nemec, M. (2004) A Dose Range-Finding Study for a Developmental Neurotoxicity Study of Acetamiprid in Rats. Project Number: WIL/21192. Unpublished study prepared by WIL Research Laboratories, Inc. 599 p.
46779203	Schaefer, G. (2006) Validation of Developmental Neurotoxicity Endpoints in Rats Administered Methimazole in Drinking Water. Project Number: WIL/99199. Unpublished study prepared by WIL Research Laboratories, Inc. 40 p.
46779204	Pitt, J. (2006) A Validation Study for Developmental Neurotoxicity Endpoints at WIL Research Laboratories, Inc.: Effect of Propylthiouracil (PTU) on Developmental Neurotoxicity Endpoints in Crl:CD (SD) IGS BR Rats (WIL-99126). Project Number: WIL/99126. Unpublished study prepared by WIL Research Laboratories, Inc. 17 p.
47237401	Li, A.; Lau, E. (2007) Acetamiprid DNT Study (WIL-21193; MRID 46255619): Response to EPA CEB Statistical Analyses and Weight of Evidence Supporting NOAEL of 10 mg/kg bwt/day. Project Number: WD0771/000/E0T0. Unpublished study prepared by Exponent Inc. 51 p.
870.7800	**Immunotoxicity**
48113401	Brown, L. (2010) Acetamiprid: 4-Week Dietary Immunotoxicity Study in the Mouse. Project Number: LGG0005. Unpublished study prepared by Huntingdon Life Sciences, Ltd. 176 p.
48113402	Moore, E. (2010) Acetamiprid: 4-Week Dietary Immunotoxicity Study in the Rat. Project Number: LGG0004. Unpublished study prepared by Huntingdon Life Sciences, Ltd. 193 p.
Non-Guideline Study	
44651818	Morishima, Y. (1997) NI-25 (PAI)--Spectra (UV/VIS, IR, NMR, MS) of NI-25: Lab Project Number: 2-9713: PTL 2-9713. Unpublished study prepared by Nippon Soda Co., Ltd. 20 p. (OPPTS 830.7050)
44651878	Higashida, S. (1998) Stability of IM-1-5 in Water: Lab Project Number: NCAS 98-012NG. Unpublished study prepared by Nisso Chemical Analysis Service Co., Ltd. 16 p.
44988412	Johnson, A. (1994) NI-25: Acute Toxicity to the Earthworm (Eisenia foetida): Lab Project Number: NPS 63/932526. Unpublished study prepared by Huntingdon Research Centre Ltd. 22 p.
44988536	Tokieda, M. (1997) Analytical Method for the Determination of Acetamiprid in Water (Validation Study): Lab Project Number: NCAS97-007: 171-4B. Unpublished study prepared by Nisso Chemical Analysis Service Co., Ltd. 68 p. (OPPTS 860.1400)

MRID	Study Title
45039702	Yang, J. (1999) Stability of Acetamiprid and Its Metabolites in Soil During Prolonged Freezer Storage: Lab Project Number: 97512642: 45754. Unpublished study prepared by Rhone-Poulenc Ag Company. 299 p. (OPPTS 860.1380)
46255609	Putt, A. (2003) IM-1-5: Full Life-Cycle Toxicity Test with Water Fleas, Daphnia magna, Under Static-Renewal Conditions. Project Number: 13798/6112. Unpublished study prepared by Springborn Smithers Laboratories. 62 p.
46255610	Putt, A. (2003) IM-1-5: Acute Toxicity to Midge (Chironomus riparius) Under Static Conditions. Project Number: 13798/6111. Unpublished study prepared by Springborn Laboratories Inc. 48 p.
46255611	Schmitzer, S. (2003) Effects of IM-1-5 on Reproduction of Rove Beetles Aleochara bilineata in the Laboratory: (Final Report). Project Number: 15722070. Unpublished study prepared by Institut fuer Biologische Analytik und Consulting IBACON GmbH. 30 p.
46255612	Klein, S. (2003) Effects of IM-1-5 on Reproduction of the Collembola Folsomia candida in Artificial Soil. Project Number: 15721016, C029622. Unpublished study prepared by Institut fuer Biologische Analytik Und Consulting IBACON GmbH. 27 p.
46255613	Rodgers, M. (2002) IM-1-5: Acute Toxicity (LC50) to the Earthworm. Project Number: NOD/217/024192. Unpublished study prepared by Huntingdon Life Sciences, Ltd. 17 p.
46255614	Luhrs, U. (2003) Effects of IM-1-5 on Reproduction and Growth of Earthworms Eisenia fetida in Artificial Soil. Project Number: 15723022. Unpublished study prepared by Institut fuer Biologische Analytik Und Consulting IBACON GmbH. 33 p.
46255615	Hatano, R. (2002) Insecticidal Activities of Acetamiprid Metabolites: IM-1-5 and IM-1-5-HCL. Project Number: NAI/04/004. Unpublished study prepared by Nippon Soda Co., Ltd. 7 p.

Appendix A. Supplemental Environmental Fate Information

Acetamiprid may be transported to surface water and groundwater via runoff, leaching, and spray drift and is classified as moderately mobile using the Food and Agriculture Organization (FAO) classification system (K_{OC}s = 157 to 298 L/kg OC). Aerobic metabolism is the primary route of degradation of acetamiprid with time to 50 percent degradation (DT_{50}) values on the order of days in aerobic soil studies and approximately three months in aerobic aquatic metabolism studies. Acetamiprid is stable to hydrolysis at 25°C, but does undergo aqueous photolysis (half-life = 34 days). Based on the low log octanol-water partition coefficient (log K_{ow} = 0.08 at 25°C), acetamiprid is not expected to bioconcentrate. Acetamiprid has a dissociation constant of 0.7 with protonation of the nitrogen on the pyridine ring (*e.g*, it has a positive charge at very low pH). At environmentally relevant pH, it is not expected to protonate (MRID 44651813). Additional details are provided in **Table 9** and **Table A1**, and in the description below.

Laboratory Degradation Studies

Degradation kinetics from studies completed prior to 2012 which did not utilize a range of polar and nonpolar solvents are not summarized in this section as they were determined to be less reliable as compared to the newly submitted studies, which utilized extraction solvents with a range of polar and nonpolar solvents.

The primary route of degradation is aerobic soil metabolism. One aerobic soil metabolism study was submitted since the last risk assessment was completed (MRID 49734002). In this study, parent DT_{50} values ranged from two to three days in four soils. Parent plus IM 1-4 DT_{50} values ranged from 30 to 36 days. As some of the degradation curves were biphasic representative model input values were higher for some soils than the DT_{50}. Representative model input half-lives for acetamiprid ranged from 2 to 15 days for acetamiprid and 70 to 337 days for acetamiprid plus IM 1-4.

Similar to the aerobic soil metabolism data, new studies were received for aerobic aquatic metabolism (MRID 49734003) and anaerobic aquatic metabolism study (MRID 49734004). Aerobic aquatic metabolism DT_{50}s were 87 and 96 days for the acetamiprid and 178 to 308 days for parent plus IM 1-4 in two sediments (MRIDs 49734003). Degradation curves were biphasic for acetamiprid plus IM 1-4 and representative model input values were 318 and 398 days. Anaerobic aquatic metabolism was much slower than aerobic metabolism, with DT_{50} values ranging from 477 to 585 days in two sediments (MRID 49734004). Degradation kinetics were not characterized for IM 1-4 as acetamiprid was relatively stable in this study.

The natural log transformation of the single-first order model was used to estimate the representative model input value of the aerobic aquatic metabolism for the silty clay loam system parent only resulting in a value of 86.6 days (MRID 49734003). When applying the standard degradation kinetics calculation paradigm, the recommended representative model input is a T_{IORE} value of 895-days for parent only. This results from the dataset being biphasic (see **Figure 1** within the body of the document for a graph of the data) with a loss of 45 to 86% of parent over 14-days followed by either no loss to 14% loss of parent between 14 to 100-days. The representative model input for parent only of 895 days (T_{IORE} value) is longer than the recommended representative model input value of 318 days (slow DFOP) for parent plus IM 1-4 for the same system. The discrepancy of having a longer input value for parent alone as compared to total residues occurs due to the differences in equations used to characterize the data and due to the variability in the dataset. In order to resolve the issue of having a longer parent only model input as compared to the total residue data input, it was decided to use the SFO model to estimate the model input for parent only. The natural log transformation method for estimating the model input was used as it weights the data so that a slightly longer half-life is estimated (86.6

days versus 47.2 days without natural log transformation). The input of 86.6 days was used as it is recognized that the SFO model does not capture the biphasic nature of the decline curve. Whether the 895-day value or the 86.6-day value is used in modeling, the risk conclusion of potential for effects to aquatic invertebrates does not change. The data set for the parent is highly uncertain due to the variability in the data. The main understanding from this study is that residues of acetamiprid and IM 1-4 undergo an initial decline followed by a very slow degradation rate.

Table A1 summarizes other laboratory degradation data for the parent and provides time to 50 percent and 90 percent decline for the parent and parent plus IM 1-4 (values designated with an 'i'). The table also summarizes representative half-life values for model inputs. These values may or may not reflect the DT_{50} and DT_{90} as degradation kinetics were often biphasic and were not always described using the single first-order model.

Table A1. Summary of Degradation and Metabolism Data Submitted for Acetamiprid

(kinetic results shown for residues of acetamiprid plus IM 1-4 are designated with an i)

Study	System Details (Kinetic Equation)	Descriptive Kinetics[1]		Representative Half-life to Derive Model Input (days)[2]	Reference Or (MRID), Study Classification And Comments
		DT_{50} (days)	DT_{90} (days)		
Abiotic Hydrolysis	pH 5, 25°C	No significant degradation		Stable	MRID 44651876. Acceptable
	pH 7, 25°C				
	pH 9, 25°C				
	pH 9, 35°C	50.8	--		
	pH 9, 45°C	12.8	--		
Atmospheric Degradation	Hydroxyl Radical (SFO)	0.14 estimated	--	--	EPIWeb Version 4.0. Acetamiprid is not expected to undergo long range transport in the vapor phase.[2]
Direct Aqueous Photolysis	pH 7, 25°C 40°N sunlight (SFO)	34	--	34 (SFO)	MRID 44988509, Acceptable, Corrected for 40°N latitude.
Soil Photolysis	--	No half-lives available		--	MRID 48563501, Supplemental, study provides evidence of degradation products.
Aerobic Soil Metabolism	IL Loam, 20°C, pH 7.2, %OC 4.2	2.99 36.3 i	49.4 196 i	14.9 (IORE) 69 (DFOP) i	MRID 49734002. Supplemental. Unextracted residues were assumed not to be parent nor IM1-4 due to extraction procedures with polar and nonpolar solvents.
	GA Sand, 20°C, pH 6.1, %OC 1.5	3.2 32.5 i	23.4 806 i	7.04 (IORE) 337 (DFOP) i	
	IA Sandy loam, 20°C pH 6.9, %OC 0.99	3.16 30.3 i	16.3 904 i	4.92 (IORE) 383 (DFOP) i	
	ND Sandy loam, 20°C, pH 6.4, %OC 6.0	1.85 29.9 i	6.15 799 i	1.85 (SFO) 331 (DFOP) i	
Aerobic Aquatic Metabolism	NC sand, 20°C, water pH 6.8, sediment pH 5.8	96.2 308 i	319 1232 i	96.2 (SFO) 398 (DFOP) i	MRID 49734003. Supplemental. Extraction procedures included polar and nonpolar solvents.
	PA silty clay loam, 20°C, water pH 6.4, sediment pH 5.4	86.6 178 i	2974 915 i	86.6 (SFO-LN) 318 (DFOP) i	
Anaerobic Aquatic	PA Loam, 20°C water pH 6.3, sediment pH 5.5	585	1943	585 (SFO)	MRID 49734004. Supplemental. Extraction

Study	System Details (Kinetic Equation)	Descriptive Kinetics[1]		Representative Half-life to Derive Model Input (days)[2]	Reference Or (MRID), Study Classification And Comments
		DT_{50} (days)	DT_{90} (days)		
	NC sandy loam, 20°C, water pH 6.7, sediment pH 5.5	477	1585	477 (SFO)	procedures included polar and nonpolar solvents.

OC=organic carbon; DT_X=time for concentration/mass to decline by X percentage; SFO=single first order; DFOP=double first order in parallel; IORE=indeterminate order (IORE); SFO DT_{50}=single first order half-life; T_{IORE}=the half-life of a SFO model that passes through a hypothetical DT_{90} of the IORE fit; DFOP slow DT_{50}=slow rate half-life of the DFOP fit, --=not available or applicable

i Value calculated for parent and IM 1-4. These values are relevant to the ecological risk assessment.

[1] DT_{50} and DT_{90} values were calculated using nonlinear regression and SFO, DFOP, or IORE equations and natural log transformed data and linear regression (SFO-LN). The equations can be found in the document, *Standard Operating Procedure for Using the NAFTA Guidance to Calculate Representative Half-life Values and Characterizing Pesticide Degradation* (USEPA, 2012d). The DT_{50} and DT_{90} values are used to describe the kinetic curves. The representative model input is a conservative input for modeling and may or may not reflect the actual decline curves.

[2] The value used to estimate a model input value is the calculated SFO DT_{50}, T_{IORE}, or the DFOP slow DT_{50} from the DFOP equation. The model chosen is consistent with that recommended using the, *Guidance for Evaluating and Calculating Degradation Kinetics in Environmental Media (NAFTA, 2012)*. The same kinetic equation used to determine the representative model input value was used to describe the DT_{50} and DT_{90} results based on standard kinetic equations.

Transformation products resulting from the environmental degradation of acetamiprid are:

- N-methyl(6-chloro-3-pyridyl)methylamine (IM 1-4)
- (E)-N1-[(6-chloro-3-pyridyl)-methyl]-N2-cyano-N1-methylacetamidine (IM 1-5)
- 6-chloronicotinic acid (IC-0)
- N^2-carbamoyl-N^1-((6-chloro-3-pyridyl)-methyl)-N^1-methylacetamidine (IM 1-2)
- 6-chloro-3-pyridylmethano (IM-0)
- N-((6-chloro-3-pyridyl)methyl)-N-methylacetamide (IM 1-3)
- N-[(6-chloro-3-pyridyl)methyl]acetamide (IM 2-3)
- N^1-[(6-chloro-3-pyridyl)methyl]-N^2-cyanoacetamidine (IM 2-1)
- Carbon dioxide

Structures of these degradates and the maximum percent of applied radioactivity present as the specified degradate are shown in **Figure A1** and **Table A2**. In some of the studies containing soil or sediment, there was a significant amount of unextracted residues. As indicated earlier, this could result in an underestimation of the maximum amount for degradates. The degradates IM 1-4, IM 1-5, IC-0, IM 1-2, and IM 1-3 were present at greater than 10% applied radioactivity and are considered major degradates. All of these degradates except IC-0 contain the pyridylmethylamine in acetamiprid that is similar to other pyridylmethylamine nicotinoid insecticides and observed in nicotine, which acts on the nicotinic acetylcholine receptor (Tomizawa and Casida, 2005). Degradates IM 1-4, IM 1-5, and IM 1-3 were also relatively stable with peaks observed at the final sampling interval or high levels observed in studies over long durations. While IM-1-3 is relatively stable and is considered a major degradate based on the hydrolysis study (pH 9 with 35°C and 45°C), it was only detected at maximums of 3-8% in the metabolism studies. Maximum concentrations of IM 1-4 were often higher than maximum concentrations of parent observed in the terrestrial field dissipations studies (**Table A4**). **Table A5** summarizes data submitted for IC-O, a major degradation that was not identified as a residue of concern.

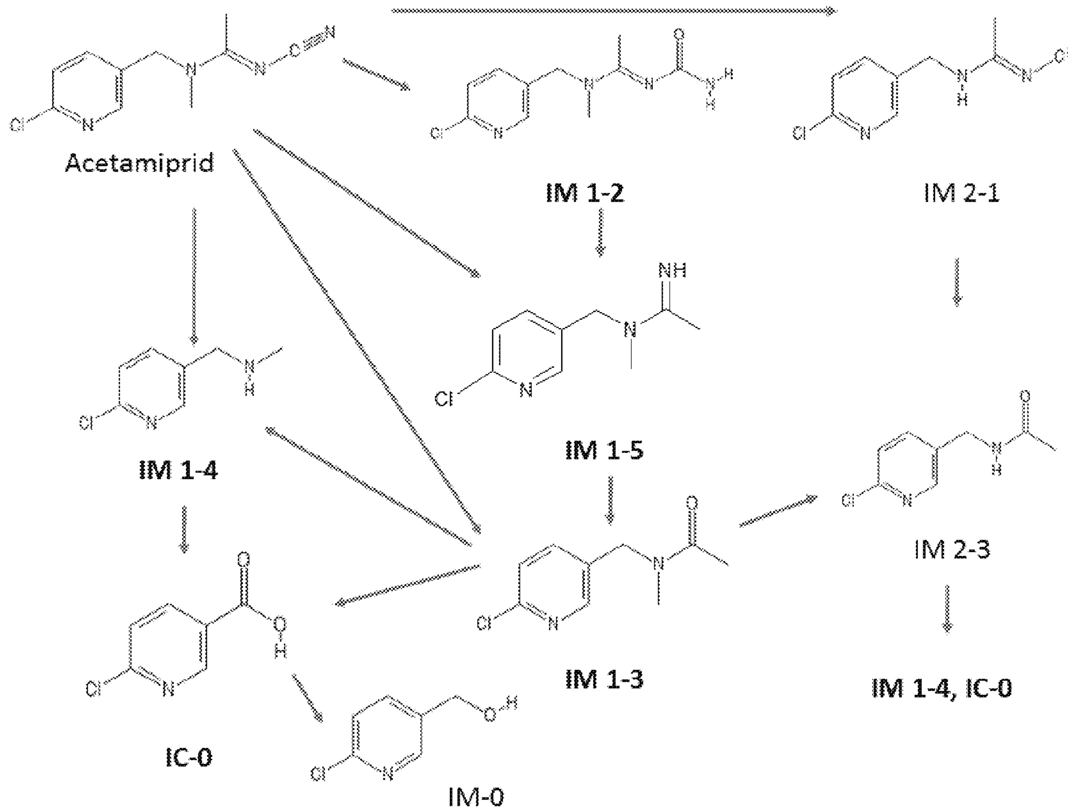


Figure A1. Potential Degradation Pathway for Acetamiprid. Bold degradates had greater than 10% applied radioactivity associated with the compound in at least one submitted fate study.

Table A2. Summary of Maximum Degradate Amounts in Environmental Fate Studies of Acetamiprid

Compound	Maximum Degradate % of Applied Radioactivity Associated with Compound (Time of Peak) Amount Detected at Final Sampling Interval in Corresponding Study							Maximum Concentration in Terrestrial Field Dissipation (µg/kg soil)
	Hydrolysis	Aqueous Photolysis	Soil Photolysis	Aerobic Soil	Anaerobic Soil	Anaerobic Aquatic	Aerobic Aquatic	
IM 1-4	15 (35 d)a 15 (35 d)a	ND	32 (24 d)a 32 (24 d)a	73 (120 d)c 61 (365 d)c	64 (61 d) 61 (125 d)	27 (270 d)a 27 (270 d)a	64 (60 d)c 34 (300 d)c	425
IM 1-5	NA	ND	NA	22 (13 d)a 13 (182 d)b	NA	NA	NA	NA
IC-0	NA	ND	16 (24 d)a 16 (24 d)a	12 (7 d) ND (182 d)	3 (125 d)a 3 (125 d)a	ND	19 (180 d) ND (300 d)	45
IM 1-2	NA	ND	1 (7 d) ND (24 d)	55 (7 d) ND (182 d)	4 (5 d) ND (125 d)	1 (90 d) ND (365 d)	21 (30 d) <1 (300 d)	88
IM-0	NA	ND	ND	2.21 (7 d) ND (187 d)	2 (1 d) ND (125 d)	NA	NA	NA
IM-1-3	61 (35 d)a 61 (35 d)a	ND	4 (24 d)a 4 (24 d)a	3 (60 d) <1 (365 d)	3 (5 d) 3 (125 d)a	8 (180 d) 6 (365 d)	1 (90 d) ND (300 d)	NA
IM-2-1	NA	NA	3 (17 d) 2 (24 d)	NA	ND	NA	NA	NA
IM-2-3	NA	NA	ND	NA	2 (5 d) ND (125 d)	NA	NA	NA

NA=not analyzed; ND=not determined
a Peak at final sampling interval in some studies
b Peak at final sampling interval in some soils
c High levels observed for > 100 days.

Mobility/Sorption

Acetamiprid is classified as moderately mobile with organic carbon normalized soil-water distribution coefficients (K_{oc}) ranging from 157 to 298 $L/kg_{organic\ carbon}$ measured in four soils and one sediment (MRID 44651883)[26]. The mean K_{oc} was 227 L/kg-organic carbon and the coefficient of variation for K_{oc} values (28%) is less than that for K_d values (66%) indicating that K_{oc} values will be better at predicting sorption across soils than K_d values. Additionally, K_ds tend to be higher as the percent organic carbon increases. There was no relationship with K_ds and pH or percent clay. Based on the sorption coefficients and persistence, acetamiprid has the potential to reach ground water, especially in vulnerable sandy soils with low organic-carbon content and/or the presence of shallow ground water. However, the maximum depth at which it was detected in terrestrial field dissipation studies was 15 cm. **Table A3** summarizes the measured sorption coefficients for acetamiprid.

Table A3. Summary of sorption coefficients measured for acetamiprid (MRID 44651883)

Soil/Sediment	Kd (L/kg)	Koc (L/kg-oc)
loamy sand, pH 4.4	0.39	157
loamy sand II, pH 6.2	3.9	266
silt loam, pH 6.6	1.1	251
clay, pH 7.5	3.5	298
sandy loam sediment, pH 5.6	4.1	164
Average	2.60	227

Field Dissipation

The terrestrial field dissipation of acetamiprid was studied at seven U.S. sites on various crops, and on bare ground plots at three sites in Canada (**Table A4**). The application rate used in all studies was 0.15 lbs ai/A. This is lower than the maximum single application rate for use on citrus of 0.25 lbs ai/A/single application, which has the highest single application rate among agricultural uses, a maximum of five applications/season, and a maximum of 0.55 lbs ai/A/season (several other fruit and nut tree crops have similar or slightly higher seasonal application rates). The dissipation half-lives for acetamiprid applied to domestic food, fiber and ornamental crops ranged from three to 14 days for residues in 0 to 15 cm (MRIDs 44988514, 44988515). The dissipation half-lives for acetamiprid applied to bare ground plots (determined in Canadian soils) ranged from five to18 days (MRID 44988625). The submitted studies generally met guideline requirements. However, because the degradate IM 1-2 converts to IM 1-4 in frozen storage within a short period of time (approximately 1 month), and many of the samples were stored for much longer periods of time (over 600 days, lengths of storage for which storage stability data were not reported) prior to analysis, the patterns of formation and decline could not be determined accurately for these major degradates. Also, at several of the study sites, negative water balances (*i.e.*, greater evaporation/total water loss from the soil than the total water input) following the final application likely precluded the possibility of significant leaching. Soil characteristics and results of the field studies are presented in **Table A4**. All reported maximum values for degradates in **Table A4** are for the period following the final application and represent individual replicates (U.S. sites) or replicate means (Canadian sites) from the 0- to 15-cm depth. The degradate IM 1-4 frequently had higher maximum concentrations in soils than the parent. In the studies conducted on cropped sites, IM 1-4 was detected at its maximum levels generally within two weeks of application. These IM-1-4 conclusions are uncertain because of the storage stability issue.

[26] Classification is based on the FAO classification system (USEPA, 2010a).

Table A4. Summary of Terrestrial Field Dissipation Study Results For Acetamiprid

MRID	Soil Texture	Study Site, Crop	Half-life in days	Max. Depth of Leaching[3]	Maximum Concentration Observed in Soil (µg/kg-soil)			
					Acet.	IM 1-4[2]	IM 1-2[2]	IC-0
44988515	sandy loam	WA, apples	3	0-15 cm (a,b,c)[3]	148	149	29	ND[4]
44988515	sand	FL, oranges	6	0-15 cm (a, b)	77	60	ND	ND
44988515	loamy sand	NY, cabbage	13	0-15 cm (a, b)	107	197	ND	ND
44988515	loam	CA, cotton	6	0-15 cm (a, b, c); 15-30 cm (d)	68	202	20	18
44988514	loamy sand	CA, vincarosea	3	0-15 cm (a, b, c); 30-45 cm (d)	46	425	26	45
44988514	sand	FL, tree ferns	14	0-15 cm (a, b, d)	151	147	ND	12
44988514	silt loam	NJ, garden mums	4	0-15 cm (a, b, d)	96	191	ND	23
44988625	sandy loam	Prince Ed. Isl., CAN., Bare ground	10	0-15 cm (a, b, c, d)	331	135.0	17.0	14.5
44988625	loam	Ontario, CAN.	5	0-15 cm (a, b, c, d)	202.5	82.0	87.5	34.5
44988625	clay loam	Manitoba, CAN., bare ground	18	0-15 cm (a, b, c, d)	209.0	41.0	68.0	17.5

[1] Acetamiprid was applied at all sites using four applications at intervals ranging from 6 to 9 days.
[2] IM 1-2 converts to IM 1-4 under storage conditions. IM 1-2 concentrations shown are likely to be lower than those that occurred in the field.
[3] a = parent; b = IM-1-4; c = IM-1-2; d = IC-0.
[4] ND = not detected.

Table A5. Summary of Environmental Fate and Transport Properties of 6-chloronicotinic acid, a Degradate of Acetamiprid

Parameter	Value(s)	Source	Study Classification	Comment
Aerobic Soil Metabolism Half-life	Half-life, linear regression[1]: 2.5 days (sandy loam soil at 20°C) 1.7 days (clay soil at 20°C) 6.6 days (loam soil at 20°C)	MRID 44651882	Supplemental	British soils and USDA classification could not be determined. Unextracted residues ranged from 3.1-20.7% of applied radioactivity. Half-lives calculated using a subset of data for clay and loam soils.
Solid-water distribution coefficient (Kd)	Average K_d in L/kg at 20°C: 0.44, loamy sand, pH 4.4 0.83, loam sand II, pH 6.2 0.28, silt loam, pH 6.6 0.28, clay, pH 7.5 2.36, sandy loam sediment, pH 5.6	MRID 44651884	Acceptable	
Freundlich solid-water distribution coefficient (KF)	K_F in L/kg (1/n) at 20°C: 0.40 (0.91), loamy sand, pH 4.4 0.79 (1.0), loam sand II, pH 6.2 0.26 (0.94), silt loam, pH 6.6 0.19 (0.82), clay, pH 7.5 1.81 (0.86), sandy loam sediment, pH 5.6	MRID 44651884	Acceptable	Freundlich exponents indicate that sorption was dependent on concentration in some soils.
Organic-carbon normalized distribution coefficient (KOC)	Average K_{OC} in L/kg OC at 20°C: 177, loamy sand, pH 4.4 56, loam sand II, pH 6.2 64, silt loam, pH 6.6 34, clay, pH 7.5 94, sandy loam sediment, pH 5.6	MRID 44651884	Acceptable	None

Appendix B. Summary of Available Effects Studies

Aquatic Organisms

<u>Freshwater Fish</u>
Two acute toxicity studies (**Table B1**) have been submitted examining the effect of acetamiprid on freshwater fish. A 96-hr flow-through study with the bluegill sunfish (*Lepomis macrochirus*; MRID 44651863) was conducted at measured concentrations of 0 (control), 11.8, 20.0, 35.4, 65.0 and 119.3 mg ai/L. No mortality was observed in any of the test concentrations, resulting in an LC_{50} >100 mg ai/L. Darkened body pigmentation was observed in all fish at all treatments, therefore the NOAEC for the study (based on alterations in fish coloration) is <11.8 mg ai/L. A 96-hr flow-through study was conducted with rainbow trout (*Oncorhynchus mykiss*; MRID 44651864) at nominal concentrations of 0 (control), 25, 35, 50, 70 and 100 mg ai/L. Mortality was 20% at the highest concentration tested, resulting in a LC_{50}>100 mg ai/L. However, sublethal effects, including darkened body pigmentation, swollen abdomen and loss of equilibrium were reported in 20% of the fish at the 50 and 70 mg ai/L concentrations, and 90% at the 100 mg ai/L concentration; resulting in a no observed adverse effect concentration (NOAEC) of 35 mg ai/L. Acetamiprid is classified as practically non-toxic to freshwater fish (rainbow trout and bluegill sunfish) on an acute exposure basis; however, sublethal effects were noted.

A 96-hr static renewal acute exposure study (MRID 44651865) of the effects of the degradate IM 1-4 on rainbow trout is available (**Table B1**). The fish were exposed at measured concentrations of 4.3, 8.5, 16.9, 33.8, 69.3 and 98.1 mg ai/L. The 98.1 mg ai/L concentration solution was removed, and separately buffered, after 100% mortality was observed in the unbuffered 69.3 mg ai/L concentration. The pH of the 69.3 mg ai/L replicate solutions ranged from 9.0 to 9.3, which may account for the observed mortality. No mortalities were reported in the other concentrations. Sublethal effects, including darkened body pigmentation and surface swimming were observed in all concentrations above 4.3 mg ai/L, which was determined to be the NOAEC for the study. The resulting LC_{50} is >98.1 mg ai/L, and so the degradate IM 1-4 is classified as practically nontoxic to freshwater fish on an acute exposure basis.

Table B1. Acute Toxicity of Technical Grade Acetamiprid and Degradate IM 1-4 to Freshwater Fish

Species	Test substance	LC_{50} (mg ai/L)	Toxicity Category	MRID	Study Classification
Rainbow trout (*Oncorhynchus mykiss*)	Technical acetamiprid	>100	Practically non-toxic	44651864	Acceptable
Bluegill sunfish (*Lepomis macrochirus*)	Technical acetamiprid	>100	Practically non-toxic	44651863	Acceptable
Rainbow trout (*Oncorhynchus mykiss*)	IM 1-4 (degradate)	>98.1	Practically non-toxic	44651865	Supplemental

A 35-day flow-through fish early life stage toxicity study (MRID 44651872) was submitted to evaluate the effect of chronic exposure on freshwater fish. Fathead minnow (*Pimephales promelas*) were exposed to acetamiprid at measured concentrations of 9.9, 19.2, 38.4, 76.0, and 147.5 mg ai/L. Mortalities of 5, 20 and 100% were reported at 38.4, 76.0 and 147.5 mg ai/L, respectively; there was no reported mortality at 19.2 mg ai/L and below. The lowest observed adverse effect concentration (LOAEC) for the study is 38.4 mg ai/L based on decreased survival and growth; the NOAEC is 19.2 mg ai/L (**Table B2**).

Table B2. Early Life-stage Toxicity of Technical Grade Acetamiprid to Freshwater Fish

Species	Test Substance	NOAEC	LOAEC	Endpoints Affected	MRID	Study Classification
Fathead minnow *(Pimphales promelas)*	Technical acetamiprid	19.2 mg ai/L	38.4 mg ai/L	Embryo and larval survival, larval growth (wet-weight and length)	44651872	Supplemental

Estuarine/Marine Fish

In a 96-h flow-through acute toxicity study (MRID 44988711), sheepshead minnows (*Cyprinodon variegatus*) were exposed to measured acetamiprid concentrations of 0 (control), 19, 32, 54, 90 and 150 mg ai/L (**Table B3**). Mortality was 10% in the 90 mg ai/L, and 100% in the 150 mg ai/L test concentrations. Lethargy was observed in all of the surviving fish at the 90 mg ai/L treatment level, but no other sublethal effects were reported. The resulting 96-hr LC_{50} is 100 mg ai/L, meaning that acetamiprid is classified as slightly toxic to sheepshead minnow on an acute exposure basis.

Table B3. Acute Toxicity of Technical Grade Acetamiprid to Estuarine/Marine Fish.

Species	Test Substance	LC_{50} (mg ai/L)	Toxicity Category	MRID	Study Classification
Sheepshead minnow *(Cyprinodon variegatus)*	Technical acetamiprid	100	Slightly toxic	44988411	Acceptable

Freshwater Invertebrates

An acute toxicity study (MRID 44651866) was submitted to assess the effect of acetamiprid on water fleas (*Daphnia magna*) at nominal concentrations of 0 (control), 12.5, 25, 50, 100 and 200 mg ai/L. Daphnid immobility (*i.e.* mortality) was reported to be 20, 45, 85 and 100%, respectively at 25, 50, 100 and 200 mg ai/L; no effects were reported at the 12.5 mg ai/L level. Based on this study, the LC_{50} for daphnids is 49.8 mg ai/L, and the NOAEC is 12.5 mg ai/L (**Table B4**). A 96-hr acute toxicity study (MRID 45932501) was submitted for the freshwater amphipod, *Gammarus fasciatus*. Test organisms were exposed to measured concentrations of 0 (control), 9.4, 18, 33, 76 and 140 µg ai/L. Mortality was 5% in the control, and 0, 10, 40, 35 and 70%, respectively, at 9.4, 18, 33, 76 and 140 µg ai/L. Lethargy was reported at 33 µg ai/L and above; based on these data the LC_{50} for gammarids is 80 µg ai/L, and the NOAEC (based on lethargy) is 18 µg ai/L. The 48-hour acute toxicity of acetamiprid to the midge, *Chironomus riparius*, was studied under static conditions (MRID 45916201). Test organisms were exposed to negative control, solvent (acetone) control and mean-measured concentrations of 6.0, 14, 26, 46 and 110 µg ai/L (measured in overlying water). After 48 hours of static exposure to acetamiprid in the presence of sediment, the 48-hr LC_{50} is 20.9 µg ai/L; the NOAEC is 6 µg ai/L (based on mortality). Based these results, acetamiprid is classified as very highly toxic to *G. fasciatus* and *C. riparius*, and slightly toxic to *D. magna*.

An aquatic invertebrate study with acetamiprid was identified in the ECOTOX database (Beketov and Liess, 2008). In this study, amphipods (*Gammarus pulex*), blackfly larvae (*Simulium latigonium*), and mayfly larvae (*Baetis rhodani*) were exposed to a single concentration of acetamiprid for 96 hours under static conditions, and LC_{50} values were subsequently determined. The results and scientific soundness of this study will be evaluated prior to endpoint selection for the upcoming acetamiprid registration review risk assessment.

The 48-hr-acute toxicity of the IM 1-4 degradate to *Daphnia magna* was studied under static renewal conditions at mean measured concentrations of 6.9, 13.9, 28.0, 55.9 and 113.0 mg ai/L (MRID 44651868). The 48- hour EC_{50} is 43.9 mg ai/L, and the NOAEC (based on mortality/immobility) is 6.9 mg ai/L. Based on the results of this study, IM 1-4 is classified as slightly toxic to *D. magna*. Two other acute exposure studies (MRIDs 44988409 and 44651867) evaluating the toxicity of acetamiprid degradates IC-0 and IM-1-2 to daphnids are available, and resulted in EC_{50} values that were greater than the highest concentration tested; therefore, these degradates are classified as practically non-toxic to daphnids on an acute exposure basis. In a 48-hour static acute toxicity study, effects of the acetamiprid degradate IM-1-5 on the sediment-dwelling freshwater midge, *Chironomus riparius*, were assessed (MRID 46255610). Test organisms were exposed to mean-measured concentrations (in the overlying water) of 0 (control), 6.0, 14, 26, 46 and 110 µg ai/L. The 48-hr LC_{50} is 68 mg ai/L, and the NOAEC is 49 mg ai/L (based on mortality). Based on this study, the acetamiprid degradate IM-1-5 is classified as slightly toxic to *C. riparius* on an acute exposure basis.

Table B4. Acute Toxicity of Acetamiprid and Degradates to Freshwater Invertebrates

Species	Test substance	EC_{50}/LC_{50} (mg ai/L)	Toxicity Category	MRID	Study Classification
Waterflea *(Daphnia magna)*	Technical acetamiprid	50	Slightly toxic	44651866	Supplemental
Amphipod *(Gammarus fasciatus)*	Technical acetamiprid	0.08	Very highly toxic	45932501	Supplemental
Midge (*Chironomus riparius*)	Technical acetamiprid	0.021	Very highly toxic	45916201	Supplemental
Waterflea *(Daphnia magna)*	IC-0 (degradate)	>95.1	Practically non-toxic	44988409	Acceptable
	IM-1-2 (degradate)	>99.8	Practically non-toxic	44651867	Acceptable
	IM 1-4 (degradate)	43.9	Slightly toxic	44651868	Acceptable
Midge (*Chironomus riparius*)	IM-1-5 (degradate)	68	Slightly toxic	46255610	Acceptable

A 21-day chronic toxicity study was conducted with daphnids at concentrations of 0 (control), 2, 5, 9, 18, 37 and 74 mg ai/L (MRID 44651871). Survival was reduced to 57% at the highest test concentration. Significant reduction in length (8%), weight (24%) and mean number of offspring (50%) were observed at 9 mg ai/L, the LOAEC. The NOAEC is 5 mg ai/L based on reduced growth and reproduction (**Table B5**).

A 21-day chronic toxicity study of degradate IM-1-5 was conducted with daphnids at nominal concentrations of 0 (control), 6.3, 13, 25, 50 and 100 mg ai/L (MRID 44651871). Significant reduction in mean number of offspring (30%) was observed at 50 mg ai/L, the LOAEC. The NOAEC is 25 mg ai/L based on impaired reproduction.

Table B5. Chronic Toxicity of Acetamiprid and Degradates to Freshwater Invertebrates

Species	Test Substance	NOAEC	LOAEC	Endpoints Affected	MRID	Study Classification
Waterflea *(Daphnia magna)*	Technical acetamiprid	5.0 mg ai/L	9.0 mg ai/L	Reduced offspring production	44651871	Acceptable

Species	Test Substance	NOAEC	LOAEC	Endpoints Affected	MRID	Study Classification
	IM-1-5 (degradate)	25 mg ai/L	51 mg ai/L	Number of young per female	46255609	Supplemental

Estuarine/Marine Invertebrates
In a 96-hr acute flow-through toxicity study (MRID 44988410), mysid shrimp (*Americamysis bahia*) were exposed to mean measured concentrations of 0 (control), 13, 23, 36, 64 and 110 µg ai/L. Mortality was 5, 10, 35 and 90%, respectively, in the 23, 36, 64 and 110 µg ai/L treatment levels. Lethargy was reported in all surviving mysids exposed to the 64 and 110 µg ai/L treatment levels. Based on these data, the LC_{50} is 66 µg ai/L, and the NOAEC is 13 µg ai/L (based on lethargy) (**Table B6**). In a 96-hr-acute flow-through toxicity study (MRID 44651869), Eastern oysters (*Crassostrea virginica*) were exposed to mean measured concentrations of 0 (control), 14, 24, 38, 58 and 100 mg ai/L. No mortality was observed at any of the treatment levels, but shell growth among oysters exposed to the 24, 38, 58 and 100 mg ai/L test concentrations was 2.1, 1.7, 0.80 and 0.41 mm, respectively; shell deposition at all of these treatment levels was significantly ($p<0.05$) reduced compared to shell growth in the negative control (2.9 mm). The 96-hr EC_{50} for Eastern oyster shell growth inhibition is 41 mg a.i/L. Based on these studies, acetamiprid is classified as very highly toxic to mysid, and slightly toxic to the Eastern oyster.

In a 96-hr static acute toxicity study (MRID 44651870) with the degradate IM 1-4, mysid shrimp (*A. bahia*) were exposed to mean-measured concentrations of 0 (control), 3.2, 6.7, 14, 27, 55 and 110 mg ai/L. Mortality was 5, 35, 65, 95 and 100%, respectively, in the 6.7, 14, 27, 55 and 110 mg ai/L treatment levels. Lethargy was reported in all surviving mysids exposed to the 27 and 55 mg ai/L treatment levels; the LC_{50} is 19 mg ai/L and the NOAEC is 3.2 mg a.i/L. Based on this study, IM 1-4 is classified as slightly toxic to mysids on an acute exposure basis.

Table B6. Acute Toxicity of Acetamiprid and Degradates to Estuarine/Marine Invertebrates.

Species	Test substance	LC_{50} (mg ai/L)	Toxicity Category	MRID	Study Classification
Eastern oyster *(Crassostrea virginica)*	Technical acetamiprid	41	Slightly toxic	44988410	Acceptable
Mysid *(Americamysis bahia)*	Technical acetamiprid	0.066	Very highly toxic	44651869	Acceptable
	99.6% IM 1-4	19	Slightly toxic	44651870	Acceptable

A 28-day flow-through chronic toxicity study (MRID 44651873) was conducted with mysid shrimp exposed at mean-measured concentrations of 0 (control), 0.93, 1.4, 2.5, 4.7, 10 and 20 µg ai/L (**Table B7**). Survival rates were 85, 80, 92, 93, 93 and 63%, respectively, in the 0.93, 1.4, 2.5, 4.7, 10 and 20 µg ai/L treatment levels; only the 20 µg ai/L treatment effects was statistically significantly ($p<0.05$) different from the control. Reduction in male dry body weight was the most sensitive endpoint, and so the NOAEC is 2.5 µg ai/L and the LOAEC is 4.7 µg ai/L.

Table B7. Chronic Toxicity of Acetamiprid and Degradates to Estuarine/Marine Invertebrates

Species	Test Substance	NOAEC	LOAEC	Endpoints Affected	MRID	Study Classification
Mysid *(Americamysis bahia)*	Technical acetamiprid	0.0025 mg ai/L	0.0047 mg ai/L	Reduced body weight in males	44651873	Acceptable

<u>Aquatic Plants</u>

Tier 1 toxicity testing with aquatic nonvascular plants indicates that acetamiprid had no significant adverse effects on the growth of green algae (*Pseudokirchneriella subcapitata*), cyanobacteria (*Anabaena flos-aquae*), freshwater diatoms (*Navicula pelliculosa*), or marine diatoms (*Skeletonema costatum*), even at the highest concentrations tested (range of maximum tested concentrations: 1.0 to 1.3 mg ai/L) (**Table B8**). Similarly, Tier 1 toxicity testing with aquatic vascular plants indicates that acetamiprid had no significant adverse effects on the growth of duckweed (*Lemna gibba*) at the highest concentration tested, *i.e.*, 1.0 mg ai/L.

Table B8. Toxicity of Acetamiprid to Aquatic Plant Species

Species	Test substance	NOAEC (mg ai/L)	EC_{50} (mg ai/L)	MRID	Study Classification
Vascular Plants					
Duckweed (*Lemna gibba*)	Technical acetamiprid	1.0	>1.0	44988415	Acceptable
Non-vascular Plants					
Green algae (*Pseudokirchneriella subcapitata*)	Technical acetamiprid	1.3	>1.3	44988414	Acceptable
Marine diatom *(Skeletonema costatum)*	Technical acetamiprid	1.0	>1.0	44988418	Acceptable
Freshwater diatom *(Navicula pelliculosa)*	Technical acetamiprid	1.1	>1.1	44988417	Acceptable
Cyanobacteria (*Anabaena flos-aquae*)	Technical acetamiprid	1.3	>1.3	44988416	Acceptable

Terrestrial Organisms

<u>Birds</u>

The acute oral toxicity of acetamiprid to 4-to-8-month-old zebra finches (*Taeniopygia guttata*) was assessed over 14 days (MRID 48407701). Acetamiprid was administered to birds at nominal doses of 1.8, 2.5, 3.6, 5, 7, and 10 mg ai/kg bw, and the resulting 14-day acute oral LD_{50} is 5.68 mg ai/kg bw (**Table B9**). At least one clinical sign of toxicity or observation of abnormal behavior was recorded in all treatment groups, including transient ruffled appearance, lethargy, wing droop, prostrate posture, loss of coordination, loss of righting reflex, depressed behavior, and minor muscle fasciculation. The acute oral toxicity of acetamiprid to mallard ducks (*Anas platyrhynchos*) was assessed over 14 days at measured doses of 0 (control), 43, 64, 85, 124, and 181 mg ai/kg-bw (MRID 44651859). Mortality was 0% in the control and 43 mg ai/kg-bw doses, and 40, 40, 80 and 100%, respectively, in the 64, 85, 124 and 181 mg ai/kg-bw doses. Sublethal effects, including abnormal behavior and loss of coordination, were reported at all doses. The 14-day LD_{50} is 84.4 mg ai/kg-bw, and the NOAEL is <43 mg ai/kg-bw based on the occurrence of sublethal effects at all treatment levels. Based on these studies, acetamiprid is classified as very highly toxic to zebra finch, and moderately toxic to mallard ducks.

Acetamiprid is highly toxic to passerine bird species on a subacute dietary basis, based on a study with zebra finch (MRID 48844901) in which birds were exposed to concentrations of 10, 30, 60, 90 and 120 mg ai/kg-diet (**Table B9**). Mortality was 70, 80 and 100%, respectively, at 60, 90 and 120 mg ai/kg-diet and there were additional adverse effects on body weight gain; there were also sublethal behavioral effects that included flight ability, convulsions, drooping wings, piloerection and depression. The subacute dietary LC_{50} is 58.2 mg ai/kg-diet based on mortality. On the basis of several studies with mallard duck and bobwhite quail, acetamiprid is considered to be practically non-toxic to non-passerine bird species on a subacute dietary basis. The subacute dietary toxicity of acetamiprid to mallard duck was assessed at concentrations of 0 (control), 200, 1000 and 5000 mg ai/kg-diet (MRID 44651861). Mortality was 0, 10 and 40% at the 200, 1000 and 5000 mg ai/kg-diet concentrations; sublethal effects including imbalance and reduced food consumption were reported at in all surviving birds at the 1000 and 5000 mg ai/kg-diet concentrations. The subacute dietary LC_{50} is >5000 mg ai/kg-diet, and the NOAEC is 200 mg ai/kg-diet based on reduced survival, behavioral effects and reduced food consumption. The subacute dietary toxicity of acetamiprid to 10-day old bobwhite quail (*Colinus virginianus*) was assessed at concentrations of 0 (control), 1000 and 5000 mg ai/kg-diet (MRID 44651860). There was no mortality at 1000 mg ai/kg-diet, at the 5000 mg ai/kg-diet concentration mortality was 20%. Food consumption was markedly depressed in the 5000 mg ai/kg-diet treatment group, the only sublethal effect reported. The LC_{50} is >5000 mg ai/kg-diet, and the NOAEC is 1000 mg ai/kg-diet based on reduced survival and decreased food consumption. Acetamiprid is classified as practically nontoxic to both mallard duck and bobwhite quail on a subacute dietary basis.

The subacute dietary toxicity of the acetamiprid degradate IM 1-4 to mallard duck was assessed at test concentrations of 0 (control), 5, 50, 500, 2500 and 5000 mg ai/kg-diet (MRID 44651862). No mortalities or sublethal effects were reported at any test concentrations; the resulting sub-acute dietary LC_{50} is >5000 mg ai/kg-diet and the NOAEC is 5000 mg ai/kg-diet. IM 1-4 is classified as practically nontoxic to mallard duck on a subacute dietary exposure basis.

Table B9. Acute Oral and Sub-acute Dietary Toxicity of Technical Grade Acetamiprid to Birds

Species	Test Substance	LC/D_{50}	Toxicity Category	MRID	Study Classification
Acute oral toxicity (LD_{50} [mg ai/kg bw])					
Zebra finch (*Taeniopygia guttata*)	Technical acetamiprid	5.68	Very highly toxic	48407701	Acceptable
Mallard duck (*Anas platyrhynchos*)		84.4	Moderately toxic	44651859	Acceptable
Sub-acute dietary toxicity (LC_{50} [mg ai/kg diet])					
Zebra finch (*Taeniopygia guttata*)	Technical acetamiprid	58.2	Highly toxic	47844901	Acceptable
Mallard duck (*Anas platyrhynchos*)		>5000	Practically non-toxic	44651861	Supplemental
Bobwhite quail (*Colinus virginianus*)		>5000	Practically non-toxic	44651860	Supplemental
Mallard duck (*Anas platyrhynchos*)	IM 1-4 (degradate)	>5000	Practically non-toxic	44651862	Acceptable

Chronic toxicity to birds was uncertain in past risk assessments because of deficiencies in avian reproduction studies with both mallard ducks (MRID 44988408) and northern bobwhite quail (MRID 449884-07). The mallard duck reproduction study in question provided an estimated NOAEC of 125 mg ai/kg diet based on reductions in adult female body weight. The bobwhite quail reproduction study reported significant reductions in hatchling body weights at all treatment concentrations, and thus failed to establish a definitive NOAEC, the LOAEC was 250 mg ai/kg-diet.

Subsequently, new studies were submitted for both species. In a one-generation reproduction toxicity study (MRID 46369204), acetamiprid was administered to mallard ducks at measured concentrations of 0 (control), 60.2, 134, 258, and 461 mg ai/kg-diet. Male body weights were significantly ($p<0.05$) reduced relative to the control at all treatment levels (70% at lowest treatment), while female body weights were significantly ($p<0.05$) reduced at the 258 and 461 mg ai/kg-diet treatment levels only (roughly 50%). The number of eggs laid, number of eggs set, number of viable embryos, and hatchling weights were also significantly ($p<0.05$) reduced at the 461 mg ai/kg-diet level compared to the control. Based on the statistically significant reduction in male bodyweight gain in the lowest treatment group, a NOAEC was not established for the study, *i.e.*, NOAEC is <60.2 mg ai/kg diet; the LOAEC is 60.2 mg ai/kg-diet. The NOAEC for reproductive effects is 258 mg ai/kg-diet. An additional one-generation reproduction toxicity study (MRID 49342202) with mallard duck is available, in which acetamiprid was administered to ducks at mean-measured concentrations of 0 (control), 24, 50, 99 and 402 mg ai/kg-diet. No mortality was observed at any treatment level, but several endpoints – 51% decrease in number of eggs laid; 48% decrease in number of eggs set; 51% decrease in number of viable embryos; 54% decrease in number of living 3-week old embryos; 49% decrease in number of hatched eggs; and, 49% decrease in number of surviving hatchlings - were significantly ($p<0.05$) adversely effected at the highest treatment level, and there was a significant ($p<0.05$) reduction of 1-6% in the ratio of the number of un-cracked eggs to eggs laid at the 99 and 402 mg ai/kg-diet treatment levels. Additionally, overall weight gain was significantly ($p<0.05$) reduced by 50% in female birds at the highest treatment level (402 mg a.i./kg-diet). Based on the statistically significant effects at 402 mg a.i./kg-diet, the NOAEC and LOAEC for the study are 99 and 402 mg ai/kg-diet, respectively. In a one-generation reproductive toxicity study (MRID 46555601), acetamiprid was administered to bobwhite quail at measured concentrations of 0 (control), 89.7, 184, 385 and 775 mg ai/kg-diet. No treatment-related effects were observed on adult survival, food consumption, or upon terminal necropsy of all decedent and surviving birds. There was a significant ($p<0.05$) reduction in adult female body weight change at the highest treatment level, and significant ($p<0.05$) reductions in eggs set, viable embryos, viable embryos to eggs set, live embryos, number hatched, number of hatchlings to eggs laid, hatchling survival, hatchling survival to eggs set and hatchling survival to number hatched. The NOAEC and LOAEC for the study are 89.7 and 184 mg ai/kg-diet, respectively.

Table B10. Reproductive Chronic Toxicity of Technical Grade Acetamiprid to Birds.

Species	Test Substance	NOAEC (mg ai/kg diet)	LOAEC (mg ai/kg-diet)	MRID	Study Classification
Mallard duck (*Anas platyrhynchos*)	Technical acetamiprid	<60.2	60.2	46369201	Supplemental
		99	402	49342202	Acceptable
Northern bobwhite quail (*Colinus virginianus*)		89.7	184	46555601	Acceptable

Mammals

The available data (MRID 44651833) indicate that acetamiprid is moderately toxic to laboratory rats (*Rattus rattus*) on an acute oral exposure basis (LD_{50}=146 mg ai/kg-bw) (**Table B11**). Acute oral toxicity tests were also conducted on several metabolites and degradation products of acetamiprid. Results of these tests show that these compounds are considerably less toxic than the parent compound, and therefore the tested degradates are classified as slightly toxic or practically nontoxic to mammals.

Table B11. Acute Toxicity of Acetamiprid and Degradates to Mammals

Species	Test substance	LD_{50} (mg ai/kg-bw)	Toxicity Category	MRID	Classification
Laboratory rat (*Rattus rattus*)	Technical acetamiprid	146	Moderately toxic	44651833	Acceptable
	IM 1-4 degradate	1088	Slightly toxic	44651834	Acceptable
	IM-1-2 degradate	2176	Practically nontoxic	44988422	Acceptable
	IM-1-2 degradate	>5000	Practically nontoxic	44651835	Acceptable
	IM-0 degradate	1792	Practically nontoxic	44988421	Acceptable
	IC-0 degradate	>5000	Practically nontoxic	44988420	Acceptable

Consistent results were reported for two chronic studies and a 13-week subchronic study of acetamiprid in laboratory rats (**Table B12**). Reduction in growth, as measured by body weight, weight gain, and food consumption, were observed at test concentrations of 400-800 mg ai/kg-diet and greater, whereas test concentrations of 160-280 mg ai/kg-diet caused no significant effects. In addition to growth endpoints, reproductive effects were also observed at 280 mg ai/kg-diet in a two-generation study (MRID 44988430). The NOAEC (160 mg ai/kg diet) that will be used for the risk assessment is based on the growth endpoints from the 2-year chronic feeding study (MRID 44988429).

Table B12. Chronic Toxicity of Acetamiprid to Mammals

Species (Test Type)	Test Substance	Measured Effect	NOAEC (mg ai/kg diet)	LOAEC (mg ai/kg-diet)	MRID
Laboratory Rat (Subchronic Dietary: 13 weeks)	Technical acetamiprid	Body weight, weight gain, and food consumption	200	800	44651843
Laboratory Rat (Chronic feeding: 24 months)	Technical acetamiprid	Female body weight, female weight gain	160	400	44988429; 45245304
Laboratory Rat (Two-generation reproduction)	Technical acetamiprid	Parental Toxicity: Body weight, weight gain, food consumption	280	800	44988430
		Offspring Toxicity: Pup weight, litter size, viability and weaning indices, age to maturation	280	800	
		Reproductive Toxicity: Litter size, pup weights	280	800	

Terrestrial Invertebrates

Two acute toxicity studies including both oral and contact toxicity tests for honey bee (*Apis mellifera*) are available; however, one study (MRID 44651874) was conducted with technical grade active ingredient (TGAI), while the other study (MRID 50015704) was conducted with the typical end-use product (TEP) EXP 60707 A (20% ai) (**Table B13**). In the oral toxicity study (MRID 44651874) with TGAI, honeybees were exposed to acetamiprid at 0 (control), 1.38, 2.6, 4.9, 10.21, 20.0 and 39.17 μg ai/bee. Mean mortality at 72-hrs was 10, 30, 36.7, 46.7, 50 and 30%, respectively. Given that none of the tested doses resulted in >50% mortality, the LD_{50} for acute oral exposure based on this study is uncertain, but was determined to be >10.21 μg ai/bee and is non-definitive. In the acute contact toxicity test, mean mortality was 40, 66.7, 46.7, 63.3, and 60% at 6.25, 12.5, 25, 50, and 100 μg ai/bee, respectively. These results do not represent a clear dose response relationship, rendering the reported LD_{50} of 8.1 μg ai/bee to be uncertain. Because mean mortality was 66.7% at 12.5 μg ai/bee, the LD_{50} is considered to be below this value (*i.e.*, <12.5 μg ai/bee). Results from this study, albeit non-definitive, suggest that acetamiprid should be considered moderately toxic to honey bees on an acute oral and contact exposure basis.

In the oral toxicity study (MRID 50015704) with TEP, honey bees were exposed to acetamiprid at 0 (control), 1.67, 2.92, 5.16, 8.61, 10.73 and 12.44 μg ai/bee. Mean mortality at 48-hrs was 0, 6, 24, 28, 68 and 90%, respectively. Sublethal effects included atypical abdominal movements and regurgitation, and occurred at higher rates (up to 22% of bees) at higher does until roughly 4-hrs after applications. The LD_{50} based on the acute oral toxicity test with TEP acetamiprid is 8.96 μg ai/bee. In the acute contact toxicity test, mean mortality at 48-hrs was 18, 18, 30, 32, 54, 54 and 96% at 0.62, 1.36, 2.99, 6.57, 14.46, 31.82 and 70 μg ai/bee, respectively. Sublethal effects included atypical abdominal movements, regurgitation and paralysis, and occurred at higher rates (up to 22% of bees) at higher does until roughly 4-hrs after applications. The LD_{50} based on the acute contact toxicity test with TEP acetamiprid is 8.96 μg ai/bee. Results from this study, albeit non-definitive, suggest that TEP (20% ai) acetamiprid should be considered moderately toxic to honey bees on an acute oral and contact exposure basis. The study is classified as supplemental because the 850.3020 guideline stipulates that the tests must be conducted with TGAI, and the TEP and active ingredient concentration tested in the study are not currently registered for use in the United States.

In addition to honey bees, the effect of acetamiprid on bumble bees (*Bombus terrestris*) was investigated in both an acute oral and acute contact toxicity test (MRID 45932503). By 48 hours in the oral test, there was 0.0, 18.2, 1.0, 37.5, and 100.0% mortality at 3.36, 6.76, 10.37, 21.36, and 31.78 μg ai/bee (measured), resulting in an LD_{50} of 22.2 μg ai/bee (NOAEL: 10.37 μg ai/bee). The contact toxicity test was conducted as a limit test, with the single test item concentration of 100 μg ai/bee (nominal); at 48-hrs there was 3.3% mortality at the limit test dose, resulting in a LD_{50} of >100 μg ai/bee (NOAEL: 100 μg ai/bee). Based on results from this study, acetamiprid is classified as practically nontoxic to bumble bees on both an acute oral and contact exposure basis; however, because exposure levels were not analytically verified in either the oral or contact exposure solutions, and because the TEP is not currently registered for use in the United States, the study is classified as supplemental.

Table B13. Acute Toxicity of Technical Grade Acetamiprid, and Typical End-use Products (TEP), to Non-target Terrestrial Invertebrates

Species	Test substance	LD_{50} (μg ai/bee)	Toxicity Category	MRID	Study Classification
Honey bee (*Apis mellifera*)	Technical acetamiprid	>10.21 (oral)	Slightly toxic	44651874	Supplemental

Species	Test substance	LD_{50} (µg ai/bee)	Toxicity Category	MRID	Study Classification
		<12.5 (contact)	Moderately toxic		
	60707 A (TEP, 20% ai)	8.96 (oral)	Moderately toxic	50015704	Supplemental
		10.53 (contact)	Moderately toxic		
Bumble bee (*Bombus terrestris*)	Technical acetamiprid	22.2 (oral)	Practically nontoxic	45932503	Supplemental
	Technical acetamiprid	>100 (contact)			

In a chronic toxicity study (MRID 50015702) adult worker honey bees were exposed *in vitro* to technical grade acetamiprid to nominal dietary concentrations of 1, 2, 40, 80, 160, 320 and 400 mg ai/kg diet (equivalent to nominal doses of 0.04, 0.07, 1.32, 2.63, 7.48, 25.94 and 32.97 µg ai/bee) for ten consecutive days. Mean mortality 10 DAT was 0, 0, 6.7, 6.7, 20, 96.7 and 100, respectively; resulting in a 10-day LC_{50} of 165.30 mg ai/kg diet (equivalent to an LD_{50} of 11.1 µg ai/bee) and a NOAEC of 73.60 mg ai/kg diet (equivalent to a NAOEL of 2.42 µg ai/bee). Additional sublethal effects included bees that displayed loss of coordination or inactivity. The chronic adult worker bee toxicity study is classified as supplemental because exposure concentrations were not verified in the actual diets provided to test subjects. In a chronic toxicity study (MRID 50015703) larval honey bees were exposed *in vitro* technical grade acetamiprid to nominal dietary concentrations of 30, 60, 120, 240, 480 and 960 mg ai/kg diet (equivalent to doses of 5.87, 12.2, 26.35, 56.58, 116.72 and 196.85 µg ai/bee) on days 3 through 6 of the study. Mean mortality 7 DAT was 31.3, 37.5, 58.3, 58.3, 68.8 and 93.8, respectively; resulting in a 7-day LC_{50} of 140.2 mg ai/kg diet (equivalent to an LD_{50} of 21.73 µg ai/larva) and a NOAEC of 78.7 mg ai/kg diet (equivalent to a NOAEL of 12.2 µg ai/larva). Additional sublethal effects included bees that displayed loss of coordination or inactivity. The chronic larval toxicity study was classified as supplemental because the duration of the study was only 7 days, and so effects on adult emergence could not be evaluated; there were additional uncertainties regarding measured test item concentrations.

Table B14. Chronic Toxicity of Technical Grade Acetamiprid, and Typical End-use Products (TEP) to Non-target Terrestrial Invertebrates

Species	Test substance	Endpoints		MRID	Study Classification
Honey bee (*Apis mellifera*)	Technical acetamiprid	NOAEC: 73.6 mg ai/kg diet	LOAEC: 158.4 mg ai/kg diet	50015702	Supplemental
Honey bee larvae (*Apis mellifera*)		NOAEC: 78.7 mg ai/kg larval diet	LOAEC: 170.0 mg ai/kg larval diet	50015703	Supplemental

A toxicity of residues on foliage study for honey bees was submitted (MRID 44651875) but was deemed unacceptable due to low recovery of acetamiprid on treated foliage; one of the technical registrants submitted a rebuttal (MRID 45932502) to the classification of this residue study, which is still being evaluated by EFED. Another toxicity of residues on foliage study for honey bees was also submitted (MRID 453469-01), was is classified as acceptable. Honey bees were exposed for 24 hours to alfalfa foliage collected 3, 8 and 24 hours after applications of either the TEP NI-25 (73.89% acetamiprid) or the TEP Procure® 50 WS (co-formulation with triflurmizole, 50% acetamiprid). There was no statistically significant ($p<0.05$) treatment-related mortality for either product or any of the time points, resulting in an RT_{25} value of <3 hrs.

In a semi-field toxicity of residue study (MRID 50015701), honey bee colonies enclosed in 100 m^2 tunnels were exposed to *Phacelia tanacetifolia* treated (using Acetamiprid 20 SG, 19.9% ai) with 0.045 lbs ai/A while bees were actively foraging. Maximum residues in pollen and nectar 3 DAT were 0.178 and 0.128 mg ai/kg, respectively; by 6 DAT residues in pollen and nectar were 0.136 and 0.012 mg ai/kg, respectively. Residues measured in comb honey 20 DAT were less than the limit of quantitation (0.01 mg ai/kg). The maximum residue in oilseed rape plants 20 DAT were 0.013 mg a.i/kg. In a full field toxicity of residue study (MRID 50091901), honey bee colonies were exposed to *Phacelia tanacetifolia* treated (using Acetamiprid 20 SG, 19.9% ai) with 0.067 lbs ai/A (after active foraging [T3]) or 0.089 lbs ai/A (both during [T1] and after active foraging [T2]). Resulting residue levels in nectar were highest 0 days after treatment (DAT), with residues of 1.17, 5.60 and 1.97 mg ai/kg, respectively, in the T1, T2 and T3 colonies. Residue levels in pollen were also highest 0 DAT, with residues of 16.96, 2.05 and 8.05 mg ai/kg, respectively, in the T1, T2 and T3 colonies. Residues in both nectar and pollen were below the level of detection (LOD = 0.003 mg ai/kg) by 14 DAT. Residues in worker bee carcasses were measured only at 1 DAT, and were 0.15, 0.02 and 0.06 mg ai/kg, respectively, in the T1, T2 and T3 colonies.

Two semi-field studies conducted to evaluate the possible effect of acetamiprid on honey bee behavior were also submitted (MRIDs 45932504; 45932505), and were classified as supplemental[27]. Both studies used tents to expose honey bees via contact with forage and/or overspray, with application rates equivalent to 0.15 and 0.09 lbs ai/A, which similar to single application rates for many registered and proposed crop uses. Mortality, flight frequency, and foraging behavior were evaluated relative to a control and a known toxic standard. No significant effects on any endpoints were observed in either study from acetamiprid treatments.

In the ECOTOX database, Iwasa *et al.*, 2004, report an LD_{50} of 7.07 µg ai/bee in a 24 hr contact study. This endpoint was based on nominal concentrations, but indicates that acetamiprid is moderately toxic to honey bees. A seven day study with speckled cutworm moth larvae (*Lacanobia subjuncta*) in a leaf litter substrate (Doerr *et al.* 2004) reported an LC_{50} of 71.3 mg ai/L. These values are provided for qualitative risk characterization only as the papers have been submitted for evaluation, and will be thoroughly reviewed.

Several open literature studies of effects on honey bees are available for acetamiprid, which will be thoroughly reviewed, but are briefly summarized here. El Hassani *et al.* (2008) exposed bees to 0.1, 0.5, and 1 µg ai and recorded increases in sucrose responsiveness, locomotor activity (total length walked), and responsiveness to water (proboscis extension reflex after stimulation by water), which are all considered activating effects since they signify increases in specific functions. The lowest tested dose of acetamiprid (*i.e.*, 0.1 µg ai/bee) in the study also impaired olfactory-related learning performance. A follow-up study by Aliouane *et al.* (2009) supported the previous water responsiveness finding. Laurino *et al.* (2011) found increased mortality in bees that ingested 50 and 100 ppm (ng ai/µl) of a formulation containing 5% acetamiprid. Mortality attributed to acetamiprid in the higher dose group was 50.85% compared to the control group, but these effects were only seen in bees that were starved for two hours before dosing. In the same study, bees fed sugar did not show any significant mortality from oral or indirect contact exposure to acetamiprid over a 72-hour observation period. In the above studies, acetamiprid generally exhibited lower toxicity to bees than a small sample of other neonicotinoids insecticides (*e.g.*, clothianidin). This trend supports a review (Iwasa *et al.*, 2004), which suggested that nitroguanidine substituted neonicotinoids (*e.g.*, clothianidin, imidacloprid, thiamethoxam and

[27] Note: non-guideline studies cannot be rated "acceptable" as there are no guideline standards.

dinotefuran) are generally more toxic to bees than cyano-substituted neonicotinoids (*e.g.*, acetamiprid, thiacloprid). However, El Hassani *et al.* (2008) did show that acetamiprid, but not thiamethoxam, had a detectable impact on bee behavior at sublethal doses.

Effects of the acetamiprid degradate IM-1-5 on adult collembola (*Folsomia candida*) were examined at concentrations of 0 (control), 0.1, 0.5. 2.5, 12.5 and 62.5 mg ai/kg artificial soil over a 28- day exposure period (MRID 46255612). Reproduction was reduced by 15, 14, 8, 6 and 24%, respectively, in the 0.1, 0.5, 2.5, 12.5 and 62.5 mg ai/kg treatments; resulting in an EC_{50} for the study of >62.2 mg ai/kg-soil. Rove beetles, *Aleochara bilineata*, were exposed to the degradate IM-1-5 at concentrations of 0 (control), 0.1, 2.5 and 62.5 mg ai/kg sand substrate over an 87-day period (MRID 462556-11). There was a 19% reduction in emergence at the highest test concentration, resulting in an EC_{50} for the study of >62.5 mg ai/kg substrate. In a 14-day acute toxicity study (MRID 44988412), earthworms (*Eisenia foetida*) were exposed to acetamiprid at 0 (control), 4, 8, 15, 30 or 60 mg ai/kg dry weight of artificial substrate. The resulting 14-day LC_{50} was 9.12 mg ai/kg-substrate, and the 7-day LC_{50} was 10 mg ai/kg substrate. In another 14-day acute toxicity study (MRID 46255613), earthworms (*Eisenia foetida*) were exposed to IM-1-5 at nominal test concentrations of 0 (control), 4, 8, 15, 30, and 1000 mg ai/kg. By 14 days, there were no mortalities, and reductions in body weight by day 14 were 2.9% in the 1000 mg/kg treatment group; the resulting LC_{50} was >1000 mg ai/kg. In a chronic toxicity study (MRID 462556-14), earthworms (*Eisenia foetida*) were exposed to the IM-1-5 degradate over an 8-week period at nominal test concentrations of 0 (control), 0.1, 0.5, 2.5, 12.5, and 62.5 mg ai/kg in artificial soil. By 28 days, there were no mortalities in the control or treatment groups, and there were no significant differences in adult body weight changes or number of juveniles produced in any treatment group compared to the control; the resulting LC_{50} was >62.5 mg ai/kg, and the NOAEC value was 62.5 mg ai/kg.

Terrestrial Plants

The effect of acetamiprid on the seedling emergence and vegetative vigor of monocots (corn [*Zea mays*], oat [*Avena sativa*], onion [*Allium cepa*], perennial ryegrass [*Lolium perenne*]) and dicots (cabbage [*Brassica oleracea*], cucumber [*Cucumis sativus*], lettuce [*Lactuca sativa*], soybean [*Glycine max*], tomato [*Lycopersicon esculentum*], and turnip [*Brassica rapa*]) crops was also tested (MRID 44988413). For the seedling emergence study, nominal concentrations were as follows: cabbage, cucumber, onion and tomato: 0.041, 0.081, 0.16, 0.33 and 0.65 lbs ai/A; corn, lettuce, oat, perennial ryegrass, soybean and turnip: 0.65 lbs ai/A. For the vegetative vigor study, nominal concentration were as follows: cabbage, oat, onion, soybean and tomato: 0.65 lbs ai/A; corn and cucumber: 0.041, 0081, 0.16, 0.33 and 0.65 lbs ai/A; lettuce: 0.005, 0.01, 0.02, 0.041, 0.081 and 0.16 lbs ai/A; perennial ryegrass: 0.041, 0.081, 0.16, 0.33 and 0.65 lbs ai/A; and turnip: 0.02, 0.041, 0.081, 0.16, 0.33 and 0.65 lbs ai/A.

The seedling emergence part of this study was classified as supplemental because only plant height was measured in this study, and not seedling weight as is required. Seedling emergence was not affected in all species at any acetamiprid dose; there were, however, reductions in shoot length of cucumber, onion, and tomato exposed at 0.15, 0.32 and 0.62 lbs ai/A. Based on the seedling emergence data, the most sensitive monocot species was onion with an EC_{25} of 0.23 lbs ai/A, and the most sensitive dicot species was cucumber, with an EC_{25} of 0.16 lbs ai/A (**Table B14**). The NOAEC (based on shoot length reductions) in cucumber (dicot) and onion (monocot) was 0.077 lbs ai/A.

The vegetative vigor part of this study was acceptable for all species except lettuce, which was classified as supplemental because significant adverse phytotoxic effects were observed in the control plants. In the vegetative vigor test, shoot length in all species was un-affected by all acetamiprid treatments; plant weight was also not affected in cabbage, corn, cucumber, oat, onion, soybean and tomato. There was, however, a reduction in the mean weight for lettuce, perennial ryegrass, and turnip exposed to various concentrations of acetamiprid. The most sensitive monocot species in the vegetative vigor test was perennial ryegrass, with an EC_{25} of 0.46 lbs ai/A and a NOAEC of 0.31 lbs ai/A. The most sensitive dicot species was lettuce, with a EC_{25} of 0.016 lbs ai/A and a NOAEC of 0.0094 lbs ai/A.

A subsequent study was submitted concerning the effect of acetamiprid on vegetative vigor on lettuce alone (MRID 45921401). In this study, the EC_{25} and NOAEC for plant weight were determined to be 0.012 and <0.0025 lbs ai/A, respectively. Shoot length was the more sensitive parameter with an EC_{25} of 0.0056 and a NOAEC of 0.0025 lbs ai/A. Two other studies (MRID 46229601 and 46229602) more closely examined the phytotoxic effects of acetamiprid on lettuce. Both studies reported that the variety of lettuce used in the first two studies, buttercrunch, accounted for the greater sensitivity of lettuce relative to other species tested, and that other varieties of lettuce exhibited relatively reduced sensitivities.

Table B14. Summary of Endpoints (lbs ai/A) in Terrestrial Plant Toxicity Studies Submitted for Acetamiprid

Species		Seedling emergence		Vegetative vigor	
		NOAEC	EC_{25}	NOAEC	EC_{25}
Monocots	Oat	0.62	>0.62	0.67	>0.67
	Corn	0.62	>0.62	0.59	>0.59
	Onion	**0.077***	**0.23***	0.65	>0.65
	Ryegrass	0.62	>0.62	**0.31***	**0.46***
Dicots	Cucumber	**0.077***	**0.16***	0.59	>0.59
	Soybean	0.62	>0.62	0.65	>0.65
	Turnip	0.62	>0.62	0.031†	0.2
	Lettuce	0.62	>0.62	**0.0025***	**0.0056***
	Tomato	0.077	0.16	0.65	>0.65
	Cabbage	0.62	>0.62	0.67	>0.67

Appendix C. Sample T-REX Input and Output

TREX MODEL INPUTS You must enable macros for this spreadsheet to work correctly

These values will be used in the calculation of exposure estimates for foliar, granular, liquid and/or seed applications of pesticides.

Chemical Identity and Application Information

Chemical Name:	**Acetamiprid**
Seed Treatment? (Check if yes)	☐ Seeding Rate (lbs/acre)
Use:	
Product name and form:	
% A.I. (leading zero must be entered for formulations <1% a.i.):	100.00%
Half-life (days):	35
Are you assessing applications with variable rates or intervals?	yes

[redacted]

Application No.	Rate	Day of Application
1	0.15	0
2	0.15	7
3	0.1	14
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		

Assessed Species Inputs (optional, use defaults for RQs for national level assessments)

What body weight range is assessed (grams)?	Birds	Mammals
Small	20	15
Medium	100	35
Large	1000	1000

Reset Model

Note: Sources of wildlife diet are assumed to be available for less than one year for this model.

Endpoints

Avian

Endpoint	Toxicity value	Indicate test species below	Optional Test Organism Body weight (g)	Optional Test Species Name	Toxicity Value Reference (MRID)
LD50 (mg/kg-bw)	5.68	Other	11.45	Zebra finch	48407701
LC50 (mg/kg-diet)	58.20	Other	14.00	Zebra finch	48844901
NOAEL (mg/kg-bw)	5.00	Mallard duck			49342202
NOAEC (mg/kg-diet)	50.00	Mallard duck			49342202

Enter the Mineau et al. Scaling Factor 1.15

Mammalian

		Acute Study	Chronic Study
Size (g) of mammal used in toxicity study Default rat body weight is 350 grams		350	350
Endpoint	Toxicity value		Reference (MRID)
LD50 (mg/kg-bw)	146.00		44651833
LC50 (mg/kg-diet)			
Reported Chronic Endpoint	160.00	mg/kg-diet	44988429
Is estimated daily dose (mg/kg-bw) reported from the available chronic mammal study? (yes or no)	no		

Estimated Chronic Daily Dose Equivalent to reported Chronic	8	mg/kg-bw based on standard FDA lab rat conversion

Avian Results

Avian Class	Body Weight (g)	Ingestion (Fdry) (g bw/day)	Ingestion (Fwet) (g/day)	% body wgt consumed	FI (kg-diet/day)
Small	20	5	23	114	2.28E-02
Mid	100	13	65	65	6.49E-02
Large	1000	58	291	29	2.91E-01
Granivores	20	5	5	25	5.06E-03
	100	13	14	14	1.44E-02
	1000	58	65	6	6.46E-02

Avian Body Weight (g)	Adjusted LD50 (mg/kg-bw)
20	6.18
100	7.86
1000	11.11

Dose-based EECs (mg/kg-bw)	Avian Classes and Body Weights (grams)		
	small 20	mid 100	large 1000
Short Grass	94.10	53.66	24.02
Tall Grass	43.13	24.59	11.01
Broadleaf plants	52.93	30.18	13.51
Fruits/pods	5.88	3.35	1.50
Arthropods	36.86	21.02	9.41
Seeds	1.31	0.75	0.33

Dose-based RQs (Dose-based EEC/adjusted LD50)	Avian Acute RQs Size Class (grams)		
	20	100	1000
Short Grass	15.24	6.83	2.16
Tall Grass	6.98	3.13	0.99
Broadleaf plants	8.57	3.84	1.22
Fruits/pods	0.95	0.43	0.14
Arthropods	5.97	2.67	0.85
Seeds	0.21	0.09	0.03

Dietary-based RQs (Dietary-based EEC/LC50 or	RQs	
	Acute	Chronic
Short Grass	1.42	1.65
Tall Grass	0.65	0.76
Broadleaf plants	0.80	0.93
Fruits/pods/seeds	0.09	0.10
Arthropods	0.56	0.65

Note: To provide risk management with the maximum possible information, it is recommended that both the dose-based and concentration-based RQs be calculated when data are available

Acetamiprid **0** **Upper bound Kenaga Residues**

Mammalian Results

Mammalian Class	Body Weight	Ingestion (Fdry) (g bwt/day)	Ingestion (Fwet) (g/day)	% body wgt consumed	FI (kg-diet/day)
	15	3	14	95	1.43E-02
Herbivores/	35	5	23	66	2.31E-02
insectivores	1000	31	153	15	1.53E-01
	15	3	3	21	3.18E-03
Grainvores	35	5	5	15	5.13E-03
	1000	31	34	3	3.40E-02

Mammalian Class	Body Weight	Adjusted LD50	Adjusted NOAEL
	15	320.88	17.58
Herbivores/	35	259.63	14.23
insectivores	1000	112.30	6.15
	15	320.88	17.58
Granivores	35	259.63	14.23
	1000	112.30	6.15

Dose-Based EECs (mg/kg-bw)	Mammalian Classes and Body weight (grams)		
	15	35	1000
Short Grass	78.77	54.44	12.62
Tall Grass	36.10	24.95	5.79
Broadleaf plants	44.31	30.62	7.10
Fruits/pods	4.92	3.40	0.79
Arthropods	30.85	21.32	4.94
Seeds	1.09	0.76	0.18

Dose-based RQs	Small mammal 15 grams		Medium mammal 35 grams		Large mammal 1000 grams	
(Dose-based EEC/LD50 or NOAEL)	Acute	Chronic	Acute	Chronic	Acute	Chronic
Short Grass	0.25	4.48	0.21	3.83	0.11	2.05
Tall Grass	0.11	2.05	0.10	1.75	0.05	0.94
Broadleaf plants	0.14	2.52	0.12	2.15	0.06	1.15
Fruits/pods	0.02	0.28	0.01	0.24	0.01	0.13
Arthropods	0.10	1.75	0.08	1.50	0.04	0.80
Seeds	0.00	0.06	0.00	0.05	0.00	0.03

Dietary-based RQs	Mammal RQs	
(Dietary-based EEC/LC50 or NOAEC)	Acute	Chronic
Short Grass	#DIV/0!	0.52
Tall Grass	#DIV/0!	0.24
Broadleaf plants	#DIV/0!	0.29
Fruits/pods/seeds	#DIV/0!	0.03
Arthropods	#DIV/0!	0.20

Note: To provide risk management with the maximum possible information, it is recommended that both the dose-based and concentration-based RQs be calculated when data are available

TREX MODEL INPUTS

You must enable macros for this spreadsheet to work correctly

These values will be used in the calculation of exposure estimates for foliar, granular, liquid and/or seed applications of pesticides.

Chemical Identity and Application Information

Chemical Name:	Acetamiprid	
Seed Treatment? (Check if yes)	☑	Seeding Rate (lbs/acre)
Use:	mustard seed	7.0
Product name and form:		
% A.I. (leading zero must be entered for formulations <1% a.i.):	100.00%	
Application rate (fl oz/cwt)	0.03	
Half-life (days):	35	
Application Interval (days):	0	
Number of Applications:	1	
Are you assessing applications with variable rates or intervals?	no	

Assessed Species Inputs (optional, use defaults for RQs for national level assessments)

What body weight range is assessed (grams)?	Birds	Mammals
Small	20	15
Medium	100	35
Large	1000	1000

Reset Model

Chemical:	Acetamiprid				Data inputs are in blue
Name of seed treatment formulation:	Acetamiprid 50 FS				
Percent AI in formulation:	100%			Density of product (lbs/gal):	8.33
Endpoints	Reported	Tested Body Weight (g)	Adjusted LD50	Size class for adjusted LD50	
Avian LD50:	5.68	11.45	6.18	Small (20g)	
Avian repro. NOAEC:	50.00		7.86	Medium (100g)	
			11.11	Large (1000g)	
Mammalian LD50:	146.00	350	320.88	Small (15g)	
Mammalian NOAEL:	160.00		259.63	Medium (35g)	
			112.30	Large (1000g)	
		Adjusted NOAEL for Mammals			
		Small (15g)	17.58		
		Medium (35g)	14.23		
		Large (1000g)	6.15		

Animal Size	Crop	Maximum Application Rate (lbs ai/A)	Maximum Seed Application Rate (mg ai/kg seed)	Avian Nagy Dose (mg ai/kg-bw/day)	Mammalian Nagy Dose (mg ai/kg-bw/day)	Available AI (mg ai ft-2)
Small	mustard seed	0.00	19.52	4.94	4.14	0.00
Medium				2.82	2.86	
Large				1.26	0.66	

Crop	Risk Quotients†					
	Avian (20 g)			Mammalian (15 g)		
	Acute (# 1)	Acute (# 2)	Chronic	Acute (# 1)	Acute (# 2)	Chronic
mustard seed	0.80	0.01	0.39	0.01	0.00	0.24
	Avian (100 g)			Mammalian (35 g)		
	Acute (# 1)	Acute (# 2)	Chronic	Acute (# 1)	Acute (# 2)	Chronic
mustard seed	0.36	0.00	0.39	0.01	0.00	0.20
	Avian (1000 g)			Mammalian (1000 g)		
	Acute (# 1)	Acute (# 2)	Chronic	Acute (# 1)	Acute (# 2)	Chronic
mustard seed	0.11	0.00	0.39	0.01	0.00	0.11

† Acute RQ #1 = (mg ai /kg-bw/day) / LD50
Acute RQ #2 = mg ai ft-2 /(LD50*bw)
Avian Chronic RQ = mg kg-1 seed / NOAEL
Mammalian Chronic RQ = mg a.i./kg-bw/day / adjusted NOAEL

Animal	Nagy allometry Food ingestion value g/day
20 g Bird	5.061777181
15 g Mammal	3.178078065
100 g Bird	14.4321986
35 g Mammal	5.125113265
1000 g Bird	64.6148732
1000 g Mammal	33.85072706

Appendix D. Sample BeeREX Input and Output

Table 1. User inputs (related to exposure)

Description	Value
Application rate	0.52
Units of app rate	lb a.i./A
Application method	foliar spray
Are empirical residue data available?	no

Table 5. Results (highest RQs)

Exposure	Adults	Larvae
Acute contact	0.13333	NA
Acute dietary	1.86	0.33
Chronic dietary	6.90	0.58

Table 2. Toxicity data

Description	Value (µg a.i./bee)
Adult contact LD50	10.53
Adult oral LD50	8.96
Adult oral NOAEL	2.42
Larval LD50	21.73
Larval NOAEL	12.2

Table 3. Estimated concentrations in pollen and nectar

Application method	EECs (mg a.i./kg)	EECs (µg a.i./mg)
foliar spray	57.2	0.0572
soil application	NA	NA
seed treatment	NA	NA
tree trunk	NA	NA

Table 4. Daily consumption of food, pesticide dose and resulting dietary RQs for all bees

Life stage	Caste or task in hive	Average age (in days)	Jelly (mg/day)	Nectar (mg/da	Pollen (mg/da	Total dose (µg a.i./bee)	Acute RQ	Chronic RQ
Larval	Worker	1	1.9	0	0	0.001	0.00	0.00
		2	9.4	0	0	0.005	0.00	0.00
		3	19	0	0	0.011	0.00	0.00
		4	0	60	1.8	3.535	0.16	0.29
		5	0	120	3.6	7.070	0.33	0.58
	Drone	6+	0	130	3.6	7.642	0.35	0.63
	Queen	1	1.9	0	0	0.001	0.00	0.00
		2	9.4	0	0	0.005	0.00	0.00
		3	23	0	0	0.013	0.00	0.00
		4+	141	0	0	0.081	0.00	0.01
Adult	Worker (cell cleaning and capping)	0-10	0	60	6.65	3.812	0.43	1.58
	Worker (brood and queen tending, nurse bees)	6 to 17	0	140	9.6	8.557	0.96	3.54
	Worker (comb building, cleaning and food	11 to 18	0	60	1.7	3.529	0.39	1.46
	Worker (foraging for	>18	0	43.5	0.041	2.491	0.28	1.03
	Worker (foraging for	>18	0	292	0.041	16.705	1.86	6.90
	Worker (maintenance of hive in winter)	0-90	0	29	2	1.773	0.20	0.73
	Drone	>10	0	235	0.0002	13.442	1.50	5.55
	Queen (laying 1500 eggs/day)	Entire lifestage	525	0	0	0.300	0.03	0.12

Appendix E. Sample TerrPlant Input and Output

TerrPlant v. 1.2.2
Green values signify user inputs (Tables 1, 2 and 4).
Input and output guidance is in popups indicated by red arrows.

Table 1. Chemical Identity.	
Chemical Name	Acetamiprid
PC code	99050
Use	Ornameatals
Application Method	Aerial
Application Form	Spray
Solubility in Water (ppm)	4250

Table 2. Input parameters used to derive EECs.			
Input Parameter	**Symbol**	**Value**	**Units**
Application Rate	A	0.52	y
Incorporation	I	1	none
Runoff Fraction	R	0.05	none
Drift Fraction	D	0.05	none

Table 3. EECs for Acetamiprid. Units in y.		
Description	**Equation**	**EEC**
Runoff to dry areas	(A/I)*R	0.026
Runoff to semi-aquatic areas	(A/I)*R*10	0.26
Spray drift	**A*D**	**0.026**
Total for dry areas	**((A/I)*R)+(A*D)**	**0.052**
Total for semi-aquatic areas	**((A/I)*R*10)+(A*D)**	**0.286**

Table 4. Plant survival and growth data used for RQ derivation. Units are in y.				
	Seedling Emergence		**Vegetative Vigor**	
Plant type	**EC_{25}**	**NOAEC**	**EC_{25}**	**NOAEC**
Monocot	0.23	0.077	0.46	0.31
Dicot	0.16	0.077	0.0056	0.0025

Table 5. RQ values for plants in dry and semi-aquatic areas exposed to Acetamiprid through runoff and/or spray drift.*				
Plant Type	**Listed Status**	**Dry**	**Semi-Aquatic**	**Spray Drift**
Monocot	non-listed	0.23	1.24	0.11
Monocot	listed	0.68	3.71	0.34
Dicot	non-listed	0.33	1.79	4.64
Dicot	listed	0.68	3.71	10.40

*If RQ > 1.0, the LOC is exceeded, resulting in potential for risk to that plant group.

Appendix F. Cranberry Aquatic Modeling Scenarios and Approach

Acknowledgement: Dr. Faruque Khan (OPP/EFED) prepared the supporting materials and developed the PFAM scenarios for cranberries (in draft) and these are reproduced with some minor edits below.

Introduction

Cranberries are low-growing, trailing, woody vine perennial crop grown commercially in Massachusetts, Wisconsin, New Jersey, Washington, Oregon, and Maine as well as small acres in Michigan, Connecticut, Rhode Island, New Hampshire, and New York (USDA, 2012). They may be harvested by flooding if used in processing or dry harvested and sold fresh without processing (Averill *et al.*, 2008). The Pesticide Flooded Application Model (PFAM) may be used to estimate concentrations in water in a bog when a field is flooded (USEPA, 2016). Large quantities of water are used to flood bogs for harvest and to protect the vines from desiccation and drastic temperature fluctuations during dormancy in the winter in northern temperate regions (Cape Cod Cranberry Growers Association, 2001; Dana, 1989). However, certain bogs, especially in the Pacific Coastal region, remain dry throughout growing period due to readily inaccessible sources of water resources or because of topographical reasons {Strik, 2002 #1340). However, the mild winters allow the vines to survive without a protective flood.

For the ecological risk assessment, exposure is evaluated in the cranberry bog for organisms that may move (*e.g.*, animals) by comparing toxicity endpoints to estimated exposure in the cranberry field. Exposure estimates are also characterized with concentrations in water that may be released after a winter flood, periodic flooding to control weeds/insects and flooding during harvest time. Winter flooding is a common practice in northern temperate regions to protect cranberry plant from drastic temperature fluctuations during dormancy {Dana, 1989 #1264}. Since periodic flood events to control weeds/insects are specific to grower discretions and are less common (Averill *et al.*, 2008), standard cranberry scenarios excluded such events in the standard scenarios. In addition, the concentration of applied pesticide of bog water can be used as drinking water exposure for human health as an interim approach until a drinking water conceptual model is developed. As some cranberry fields are not intermittently flooded, aquatic exposure is also estimated using the pesticides in water calculator model, that does not simulate flooding and this model estimates exposure in the index reservoir and EPA standard pond.

This appendix provides documentation for the interim scenarios developed to estimate pesticide concentrations in water resulting from applications of pesticides to cranberry bog when using the PFAM. Scenarios include information loaded onto the "crop", "physical", and "watershed" tabs in PFAM. Scenarios were developed for Massachusetts (MA_Cranberry Winter Flood.PFS), Oregon without a winter flood (OR_Cranberry_No Flood.PFS), Oregon with a winter flood (OR_Cranberry_Winter Flood. PFS) and Wisconsin (WI_Cranberry_Winter Flood.PFS). These interim scenarios were developed with specific meteorological data to represent major cranberry production areas for these three states. They are currently in review in the division to become standard scenarios.

Crop, Physical, and Watershed Tabs

A conceptual model to simulate movement of water into an adjacent receiving waterbody is not currently available for cranberries. The "watersheds tab" is thus not applicable to cranberry modeling at this time. Model input values for the "crop tab" and "physical tab" are provided in Table D1 for all the aforementioned scenarios.

Table D1. Summary of Model Inputs for the Crop Tab and Physical Tab

Parameter	Value	Source/Reference
Crop Tab		
Zero height reference	5/01 (MA)[1] 4/15 (OR)[2] 5/01(WI)[3]	Since cranberry is a perineal crop, early spring leafing of cranberry was assumed based on Crop Group 13 document prepared by Health Effects Division (USEPA, 2006). Values are set to keep Evapotranspiration(E/T) and canopy coverage terms working correctly for this perineal crop scenario.
Days from zero height to full height	1 (MA, OR and WI)	Values are set to keep E/T and canopy coverage terms working correctly for perineal crop scenario.
Days from Zero Height to Removal	291 (MA, OR, and WI)	Values are set as harvest dates to keep E/T and canopy coverage terms working correctly for this perineal scenario. As a perennial crop, the vines are not removed from the field after harvest.
Maximum Fractional Areal Coverage	1.0 [assume 100%]	Assumed based foliage coverage
Physical Tab		
Meteorological files	MA w14765 OR w24221 WI w14920	Meteorological data available at EPA models web site (SAMSON data). Stations correspond to Providence, RI (w14765), Eugene for MA, OR (w24221), and La Crosse, WI (14920)
Latitude	RI 41.6° OR 44.7° WI 43.8°	Corresponds to latitude of meteorological station. MA corresponds with the meteorological station located in Providence, RI.
Area of application (m2)	1	This input except 0 does not have an impact on the concentration estimated inside the cranberry bog and for the ecological risk assessment. No drinking water scenario was developed.
Weir leakage (m/d)	0	PFAM default
Benthic leakage (m/d)	0	PFAM default
Mass transfer coefficient (m/s)	$1x10^{-8}$	PFAM default
Reference depth (m)	0.458	Depth of as weir height, per PFAM guidance.
Benthic depth (m)	0.05	PFAM default
Benthic porosity	0.50	PFAM default
Dry bulk density (g/cm3)	1.35	Average bulk density ranges from 1.0 to 1.7 (g/cm3) (Davenport and MeMoranville, 1993)
FOC Water column on SS	0.04	PFAM default
FOC benthic	0.01	PFAM default
SS (mg/L)	30	PFAM default
Water column DOC (mg/L)	5.0	PFAM default
Chlorophyll CHL (mg/L)	0.005	PFAM default
Dfac	1.19	PFAM default

Parameter	Value	Source/Reference
Q10	2	PFAM default
[1] (MA) MA_Cranberry Winter Flood.PFS [2] (OR) OR_Cranberry_No Flood.PFS, and OR_Cranberry_Winter Flood. PFS [3] (WI) WI_Cranberry_Winter Flood.PFS		

Applications and Floods Tabs

The released water from cranberry bog estimated environmental concentrations (EECs) may be used to help characterize risk outside of the cranberry fields. Therefore, maximum application rates on the label are simulated, and are reflected in the "applications" tab according to label directions.

Table D2. Summary of model inputs for the Applications Tab

Parameter	Value	Comment, Source
Applications Tab		
Apply Pesticide on Specific Days or Apply Pesticide Over a Distribution of Days	Choose Specific Days (for ecological only)	User specified date for aquatic exposure assessment
Month, Day	XX/XX XX/XX	Dependent on pesticide, pre-emergence vs post-emergence, pre-flood or post-flood label recommendations
Mass Applied (kg/ha)	X.XX X.XX	Dependent on label rate
Slow Release (1/day)	0	This parameter is used if the formulation slowly releases the pesticide over time. The default input is zero, assuming the chemical is not released slowly. If chemical specific information of release rate available that may be used to develop this input.
Drift Factor	0	Assumed 100% Efficiency

The flood tab was parameterized based on typical winter flooding and flooded harvest events. A winter flood schedule was incorporated based on standard practices used for growing cranberry. In general, harvest occurs between September and November (Averill *et al.*, 2008). Cranberry fields are flooded just prior to harvest then flood water is released after a few days. The duration from harvest to release generally lasts for 3 days. The information for the length of winter flood can be obtained from several sources.[28,29] Bogs may also be flooded over the winter from December through March 15 (Cape Cod Cranberry Growers Association, 2001)[30]. A winter flood with flooded harvest scenario was developed for MA, OR, and WI. Since winter flooding and flooded harvest schedules do not fluctuate among these states. "Flood Tab" parameters are provided below in Table D3. Three standard scenarios were developed – one each for Massachusetts, Oregon and Wisconsin with specific meteorological data to represent major cranberry production areas for these states (see Table D1).

[28] Available at: http://www.umass.edu/cranberry/downloads/CP-08.pdf (Accessed April 25, 2017).
[29] Available at: http://www.wiscran.org/cranberries/ (Accessed April 25, 2017).
[29] Availabel at: http://www.cranberries.org/how-cranberries-grow/water-use (Accessed April 25, 2017).

Table D3. Summary of Model Inputs for the Flood Tab[A] (Winter Flood is Applicable for MA, OR and WI)

Parameter				Value				Comment, Source
Floods Tab								
Reference Date				December 15				Generally, winter flooding is a common practice for cranberry production.
Gradual or Sharp Transition				Sharp				This parameter simulates the release of water from the cranberry bog on a specific date.
Number of Events				5				Number of events needed to capture flooding and releases over an entire year and simulate the holding period.
Fill Level		Weir		Min. Level		Turn over		Turn over assumed negligible for cranberry
Days	(m)	Days	(m)	Days	(m)	Days	d-1	
0[A]	0.305[B]	0	0.458[C]	0	0.305	0	0	Cranberry field remains flooded during winter (December 15)[B]
90	0	90	0	90	0	90	0	Drain field 90 days after winter flood (3/15)[B]
285	0.305	285	0.458	285	0.305	285	0	Flooded for harvest (10/15)
288	0	288	0	288	0	288	0	Post-harvest release of flood (10/18)[D]
349	0.305	349	0.458	349	0.305	349	0	Flood field for winter 12/15

[A] Generic Input table applicable for winter flood scenario and applicable to MA, OR and WI.
Reference Date: Initial date for winter flood
[B] Winter flood level. The winter flood begins as early as December 1 and is drained sometime between mid-February and mid-March (Averill *et al.*, 2008).
[C] Arbitrary weir height was set at higher level than flood level to maintain flooding condition inside cranberry bog.
[D] Generally, harvest water is moved from bog to bog and is held for two to five days to allow settling of particles and nutrients before release of the water to adjacent receiving waters (Averill *et al.*, 2008).

Certain bogs, especially in the Pacific Northwest Coastal region, could remain dry throughout the growing period due to readily inaccessible water resources or because of topographical reasons (Strik and Davenport, 2002). However, many growers in Pacific Northwest coastal region prefer flooded harvest over dry harvest. Therefore, an "OR No Winter Flood Cranberry" scenario is developed for flooded harvest. Table D4 provides scenario inputs for "OR No Winter Flood Cranberry" scenario.

Dry harvest is also an option where scarcities of water for harvest exist. Fresh cranberries sold in grocery stores, are generally dry harvested. While only about 5% of cranberries are dry harvested in Massachusetts, a higher percentages are dry harvested in other states. The Pesticide in Water Calculator (PWC)[31] model with an appropriate surrogate crop scenario (*e.g.*, PWC Scenario: ORberriesOP for the North Pacific Region) can be used in estimating aquatic exposure for dry harvest scenario for surface water.

[31] Available at: https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/models-pesticide-risk-assessment (Accessed April 25, 2017).

Table D4. Summary of Model Inputs for the Flood Tab (OR_Cranberry_No Flood.PFS; Applicable in OR only)

Parameter				Value				Comment, Source
Floods Tab								
Reference Date				January 1				No winter flooding for cranberry production applicable in the Pacific Northwest cranberry production
Gradual or Sharp Transition				Sharp				This parameter simulates the release of water from the rice paddy on a specific day.
Number of Events				4				Number of events needed to capture flooding and releases over an entire year and simulate the
Fill Level		Weir		Min. Level		Turn over		Turn over assumed negligible for cranberry
Days	(m)	Days	(m)	Days	(m)	Days	d-1	
0	0	0	0	0	0	0	0	No winter flood Reference date (January 01)
285	0.305	285	0.458	285	0.305	285	0	Flood field for winter flood 10/15
288	0	288	0	288	0	288	0	Release field after harvest
365	0	365	0	365	0	365	0	Remain dry

Appendix G. Example Aquatic Modeling Output and Input Batch Files

All modeling calculations, inputs, and results are available in the attached water modeling Excel file titled 099050_DP441939_RR_aquatic modeling.xlsx. Below is an example output summary file from the PWC modeling. Results from residential modeling runs are described separately in Appendix F.

Aerial Application to Ornamentals (TTR including Parent plus IM 1-4)

Summary of Water Modeling of Parent+IM-1-4 and the USEPA Standard Pond

Estimated Environmental Concentrations for Parent+IM-1-4 are presented in Table 1 for the USEPA standard pond with the FLnurserySTD_V2 field scenario. A graphical presentation of the year-to-year peaks is presented in Figure 1. These values were generated with the Pesticide Water Calculator (PWC), Version 1.52. Critical input values for the model are summarized in Tables 2 and 3.

This model estimates that about 4% of Parent+IM-1-4 applied to the field eventually reaches the water body. The main mechanism of transport from the field to the water body is by runoff (68.3% of the total transport), followed by spray drift (31.3%) and erosion (0.37%).

In the water body, pesticide dissipates with an effective water column half-life of 312.1 days. (This value does not include dissipation by transport to the benthic region; it includes only processes that result in removal of pesticide from the complete system.) The main source of dissipation in the water column is metabolism (effective average half-life = 350.2 days) followed by photolysis (2868.3 days) and volatilization (3.499723E+09 days).

In the benthic region, pesticide dissipates very slowly (507.5 days). The main source of dissipation in the benthic region is metabolism (effective average half-life = 507.5 days). The vast majority of the pesticide in the benthic region (96.08%) is sorbed to sediment rather than in the pore water. While most of the pesticide in the benthic region is sorbed, the pore-water concentration is estimated as the concentrations dissolved in water in the benthic region.

Table 1. Estimated Environmental Concentrations (ppb) for Parent+IM-1-4.

Peak (1-in-10 yr)	28.5
4-day Avg (1-in-10 yr)	28.3
21-day Avg (1-in-10 yr)	27.5
60-day Avg (1-in-10 yr)	25.7
365-day Avg (1-in-10 yr)	17.7
Entire Simulation Mean	12.1

Table 2. Summary of Model Inputs for Parent+IM-1-4.

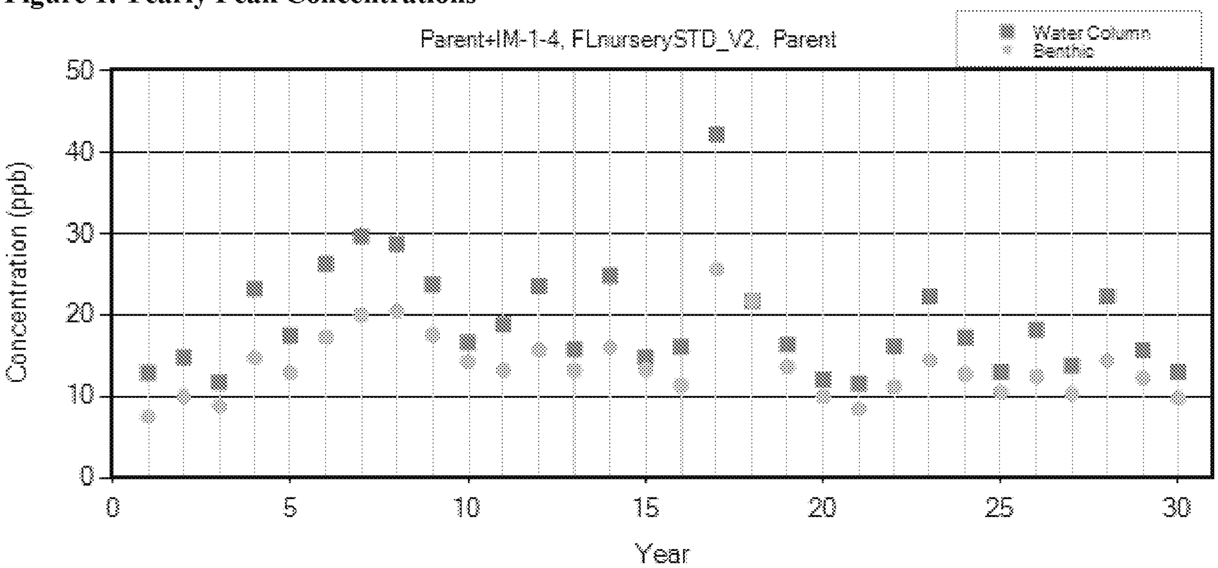
Scenario	FLnurserySTD_V2
Cropped Area Fraction	1
Koc (ml/g)	227.2
Water Half-Life (days) @ 20 °C	481
Benthic Half-Life (days) @ 20 °C	697
Photolysis Half-Life (days) @ 40 °Lat	34
Hydrolysis Half-Life (days)	0
Soil Half-Life (days) @ 20 °C	397
Foliar Half-Life (days)	0

Molecular Weight	222.68
Vapor Pressure (torr)	7.50E-10
Solubility (mg/l)	4250
Henry's Constant	2.11E-12

Table 3. Application Schedule for Parent+IM-1-4.

Date (Mon/Day)	Type	Amount (kg/ha)	Eff.	Drift
6/1	Above Crop (Foliar)	0.58	0.95	0.125
6/8	Above Crop (Foliar)	0.033	0.95	0.125

Figure 1. Yearly Peak Concentrations



Aerial Application to Ornamentals (Parent Only)

Summary of Water Modeling of Acetamiprid and the USEPA Standard Pond

Estimated Environmental Concentrations for Acetamiprid are presented in Table 1 for the USEPA standard pond with the FLnurserySTD_V2 field scenario. A graphical presentation of the year-to-year peaks is presented in Figure 1. These values were generated with the Pesticide Water Calculator (PWC), Version 1.52. Critical input values for the model are summarized in Tables 2 and 3.

This model estimates that about 3.4% of Acetamiprid applied to the field eventually reaches the water body. The main mechanism of transport from the field to the water body is by runoff (62.9% of the total transport), followed by spray drift (36.7%) and erosion (0.41%).

In the water body, pesticide dissipates with an effective water column half-life of 75.3 days. (This value does not include dissipation by transport to the benthic region; it includes only processes that result in removal of pesticide from the complete system.) The main source of dissipation in the water column is metabolism (effective average half-life = 77.3 days) followed by photolysis (2868.3 days) and volatilization (3.499723E+09 days).

In the benthic region, pesticide dissipates very slowly (507.5 days). The main source of dissipation in the benthic region is metabolism (effective average half-life = 507.5 days). The vast majority of the pesticide in the benthic region (96.08%) is sorbed to sediment rather than in the pore water.

Table 1. Estimated Environmental Concentrations (ppb) for Acetamiprid.

Peak (1-in-10 yr)	15.7
4-day Avg (1-in-10 yr)	15.4
21-day Avg (1-in-10 yr)	14.1
60-day Avg (1-in-10 yr)	11.2
365-day Avg (1-in-10 yr)	4.07
Entire Simulation Mean	2.68

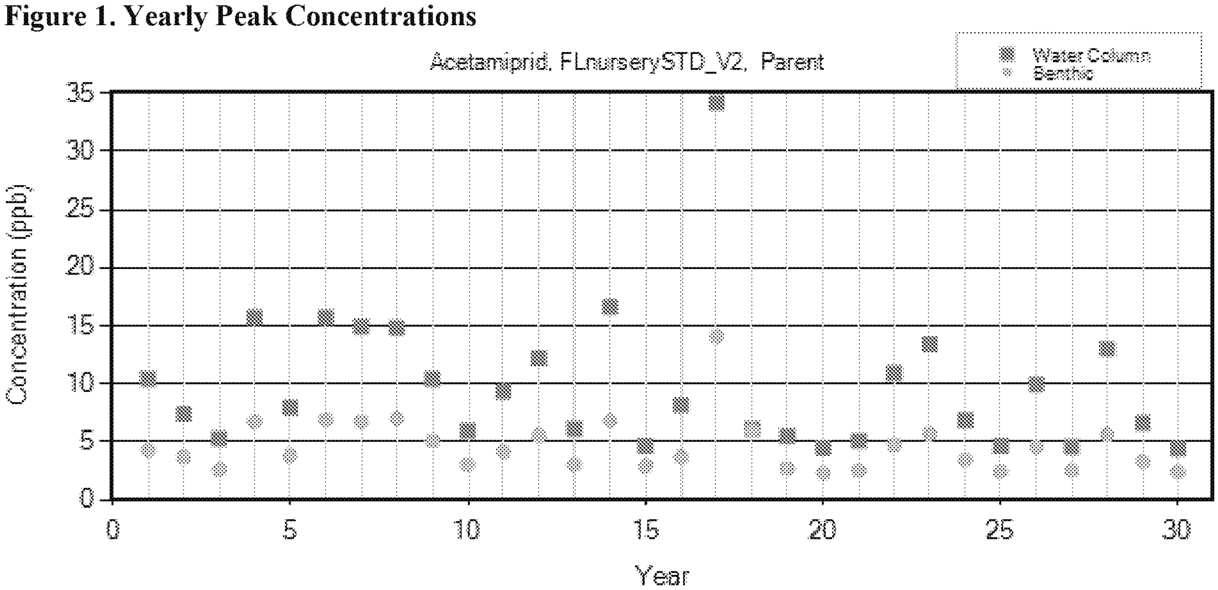
Table 2. Summary of Model Inputs for Acetamiprid.

Scenario	FLnurserySTD_V2
Cropped Area Fraction	1
Koc (ml/g)	227.2
Water Half-Life (days) @ 20 °C	106.2
Benthic Half-Life (days) @ 20 °C	697
Photolysis Half-Life (days) @ 40 °Lat	34
Hydrolysis Half-Life (days)	0
Soil Half-Life (days) @ 20 °C	12
Foliar Half-Life (days)	0
Molecular Weight	222.68
Vapor Pressure (torr)	7.50E-10
Solubility (mg/l)	4250
Henry's Constant	2.11E-12

Table 3. Application Schedule for Acetamiprid.

Date (Mon/Day)	Type	Amount (kg/ha)	Eff.	Drift
6/1	Above Crop (Foliar)	0.58	0.95	0.125
6/8	Above Crop (Foliar)	0.033	0.95	0.125

Figure 1. Yearly Peak Concentrations



Appendix H. Method of Estimating Aquatic Exposure from Urban/Residential Uses

The conceptual model and assumptions used to estimate aquatic exposure for pyrethroids in a residential area (USEPA, 2016, DP429641) were also used to estimate aquatic exposure for the acetamiprid ecological risk assessment. Calculations were completed specific to acetamiprid label recommendations, where label recommendations could be used to estimate a per area rate. There are some recommended use patterns on labels that could not easily be translated into a per area rate and these were not considered in the calculations (*e.g.*, rates were provided in lb/linear ft or lb per gallon).

In order to simulate applications to residential areas, where the entire field size will not be treated and where the land will be covered by both pervious and impervious surfaces, multiple PWC simulations are performed and the time series are combined (each daily EEC from different time series outputs are added) from the simulations to obtain a final set of exposure estimates for the simulated area. The scenarios simulated and combined assumed are described in more detail in the pyrethroid risk assessment (USEPA, 2016, DP429641). Table F1 summarizes the modeling completed to estimate aquatic exposure for acetamiprid. The "application rate" column provides the application rate provided on the label on an area basis (usually square feet) and converted to a lbs ai/A rate, as this is the standard rate used in aquatic modeling. It is recognized that this rate would not be expected to be used over an entire acre. The PRZM scenario column describes the PRZM scenario used to model each application type and the application rate assumed in modeling. The spot treatment under slabs, foundations, and wood piles at a rate of 18 and 24 lbs ai/A was not simulated for surface water modeling because the rate is assumed to be applied only in small spots that are not accessible to major runoff events.

Table H1. Summary of Modeling Assumptions Completed for Acetamiprid Residential Areas

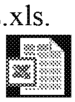
Use site	Application Rate on label (lb ai/A)	PRZM Scenario	Percent of Quarter Acre Lot	App Rate for Modeling lbs ai/A (kg/ha)
Perimeter	0.189 lb ai/A	CArightofwayRLF_V2	17%	0.030 (0.033)
Garden/Ornamentals	0.15 lbs ai/A	CAresidentialRLF	11%	0.010 (0.011)
Impervious Surface	0.189 lb ai/A	Impervious Surface	0.0115%	2.2×10^{-5} (2.5×10^{-5})

As not an entire watershed is expected to be filled with quarter acre lots, a final percent area adjustment factor of 58.7 % is applied to the final estimated EEC of combined time series. This is based on an assumption that a 10 hectare watershed contains 58 lots (USEPA, 2016, DP429641).

To bracket a high end and low end aquatic exposure estimate for residential use patterns, an assumption was made assuming all houses in a watershed were treated, half of the houses were treated (multiplying the all houses treated EEC by 0.5), and one of the houses was treated (multiplying the all houses treated EEC by 1/58).

Residential applications were assumed to be applied by back pack or hand held sprayer and were assumed not to result in spray drift. Applications were assumed to occur on June 1st.

The combined time series results are documented in the spreadsheet titled 099050_DP441940_residential EECs.xls.



0990550_DP441940_residential EEC.xls

Appendix I. Summary of End-Use Products that Contain Acetamiprid and Additional Active Ingredients

Table I1. Summary of End-Use Products that Contain Acetamiprid and Additional Active Ingredients[1]

Registration #	Formulation	Name	% Active Ingredient	Active Ingredient
8033-96	Water soluble packets	F4688® 50 WSP INSECTICIDE TERMITICIDE	27.27	Bifenthrin
			22.73	Acetamiprid
8033-108	Ready to Spray Hose End Sprayer	ACETAMIPRID+TRITICONAZOLE CONCENTRATE® INSECTICIDE & FUNGICID	0.26	Acetamiprid
			0.78	Triticonazole
8033-109	Flowable	F5688® 11% ME INSECTICIDE TERMITICIDE	6	Bifenthrin
			5	Acetamiprid
8033-116	Flowable	JUSTICE® OF INSECTICIDE	13	Acetamiprid
			10	Bifenthrin
8033-117	Scatter Bait for Use Indoors	RF2157® INSECTICIDE	0.5	Acetamiprid
			0.075	cis-9-Tricosene
8033-131	Flea Control Spot On	RF2213® AE CDSO	5	S-Methoprene
			20	Etofenprox
			9.5	Acetamiprid
			8	Piperonyl butoxide
66222-264	Flowable	ADA® 11280 INSECTICIDE	7.3	Acetamiprid
			9.1	Novaluron
ID170002	Flowable	ADA® 11280 INSECTICIDE	7.3	Acetamiprid
			9.1	Novaluron
OK110002	Flowable	F5688® 11% ME INSECTICIDE TERMITICIDE	6	Bifenthrin
			5	Acetamiprid
UT170003	Flowable	ADA® 11280 INSECTICIDE	7.3	Acetamiprid
			9.1	Novaluron

[1] Based on an OPPIN search of active products on July 5, 2017.

Appendix J. Agricultural Acetamiprid Uses

Table J1. Summary of Use Information for Agricultural Crops

Use Site	Equip-ment	App. Timing	Max Rate / App. (lb ai/A)	Max Rate / CC (lb ai/A)	Max # of CC / Yr[b]	Max # Apps / Yr. or CC[g]	Max Rate / Yr. (lbs ai./A)	MRI (d)
10-10. Citrus Fruit	A, G, C	All	0.249	--	--	5**	0.55	7
11-10. Pome Fruit	A, G	All	0.15	--	--	4	0.6	12
13-07A. Caneberry	A, G, C	All	0.10	--	--	5	0.50 - 0.57	7
13-07B. Bushberry	A, G, C	All	0.10	--	--	5	0.50 - 0.57	7
13-07F. Small fruit vine climbing subgroup, except fuzzy kiwifruit	A, G	All	0.101	--	--	2	0.201	14
13-07G. Low growing berry subgroup (including cranberries)	A, G, C	All	0.131	--	--	2	0.263	7
	A, G, C	All	0.132	0.26 - 0.30	3	2/CC 6/yr	0.89	7
14. Tree Nuts	A, G	All	0.18	--	--	4	0.72	14
1C. Tuberous and corm vegetables	A, G	All	0.075	--	--	4	0.3	7
3-07. Bulb Vegetable	A, G	All	0.15	--	--	4	0.6	7
	A, G, C	Before transplant	0.15	0.15	(1 assumed)	--	0.55 across products*	--
4. Leafy Vegetables (except Brassica vegetables)	A, G	All	0.075	--	--	5	0.375e	7
	A, G, C	Before transplant	0.15	0.15	(1 assumed)	--	--	--
5. Brassica (Cole) Leafy Vegetables	A, G, C	Before transplant	0.15	0.15	--	--	0.55 across products*	--
5A. Head & Stem Brassica	A, G	All	0.075	--	--	5	0.375	7
5B. Leafy Brassica greens	A, G	All	0.10	--	--	4	0.375	7
6A. Edible-podded legume vegetables	A, G	All	0.10	--	--	3	0.3	7
6B. Succulent shelled pea and bean	A, G	All	0.10	--	--	3	0.30	7
8. Fruiting Vegetables (except cucurbits)	A, G, C	Before transplant	0.15	0.15	(1 assumed)	--	0.55 across products*	--
8-10. Fruiting Vegetable	A, G	All	0.075	--	--	4	0.3	7
9. Cucurbit Vegetables	A, G	All	0.10	--	--	5	0.50	5

Use Site	Equip-ment	App. Timing	Max Rate / App. (lb ai/A)	Max Rate / CC (lb ai/A)	Max # of CC / Yr[b]	Max # Apps / Yr. or CC[g]	Max Rate / Yr. (lbs ai./A)	MRI (d)
	A, G, C	Before transplant	0.15	0.15	--	--	0.55 across products*	--
Alfalfa (ID SLN)	A, G	All	0.075	0.23	(1 assumed)	3/CC**	--	14
Alfalfa (AZ SLN)	A, G	All	0.15	0.39-0.40		4/CC	--	7
Alfalfa (ID and OR SLN)	A, G	All	0.075	--		--	--	--
Asparagus	A, G	All	0.10			2	0.20	10
Canola (seed treatment)	Se	Spring planted seed treatment	0.03		--	--	0.03	--
Clover (ID, OR, WA only)	A, G	All	0.075	--	--	1	0.075	--
Sweet Corn	A, G	All	0.10	--	--	2	0.21	14
	A, G	All	0.099	--	--	4**	0.21	14
Cotton	A, G	All	0.10	--	--	4	0.40	7
Cotton - Various SLNs in AZ, AR, LA, MS	A, G	All	0.15	0.4	--	2/CC	--	7
Cranberry	C	At crop emergence [d]	0.13	--	--	2	0.26	7
Mustard (seed treatment)	SeC	Se	0.03	--	--	--	0.03	--
Ornamentals	G	All	0.0011 lb / gal[c]	--	--	5	0.55	7
	A, G, C	All	0.15	--	--	4**	0.55	7
Ornamentals [f]	A, G, C	All	0.52	--	5	--	0.55	
Potato	SeC/ SeF	Seed treatment	0.54[a]	--	--	--	0.3	--
	C	At crop emergence	0.075	--	--	4	0.31	7
Soybean	A, G	All	0.041	0.082	--	2/CC	--	7
Stone Fruit Crop Group 12	A, G	All	0.15	--	--	4	0.6	10
Tobacco	A, G	All	0.075	--	--	4	0.3	7
Turnip (Greens)	A, G	All	0.10	--	--	4**	0.38	7
WA110010 (Washington Only)	A, G	All	--	--	--	4	0.55	12

All= All site stages possible (*e.g.*, timing determined solely by pest pressure); A=aerial application, B=Broadcast application; G=groundboom application which may allow for airblast; C=chemigation; SeC=seed treatment commercial; SeF=seed treatment on the farm; WSP=water soluble packet; SC=soluble concentrate; WP=wettable powder; S=suspension; RTU=ready to use; L=liquid; CC=crop cycle; App=Application; CC=crop cycle; MRI=minimum retreatment interval
* Applicable to some but not all labels.
** Max number of apps not at max rate.
a Specific Rate: Product label provides a maximum application rate (per seed weight) of 0.3 fl oz product/cwt based on a seeding rate of 2000 lbs potato seed per acre. When these parameters are inputted into T-REX, the resulting maximum single application rate (per area) of 0.54 lbs a.i./acre (equivalent to 78.09 mg a.i./kg seed).
b This column was calculated based on the max number of applications on a crop cycle basis and the max number of applications on

a yearly basis specified in the PLUS report. Labels also have a max number of crop cycles per year specified on many labels for specific crops.
c Max single rate given as 6 water soluble packets per 100 gal. Max yearly rate given as 22 water soluble packets/A (0.55 lb ai/A) per year. (Single AI rates calculated from this information as 0.025 lb ai per water soluble packet).
d Specific Rate: Maximum of 1 Crop Cycle per Year; Do not flood the treated site until 60 days the last application.
e Do not exceed 0.375 lbs ail/A/year including a pre-transplant application.
f Based on information provided by one of the technical registrants, Nisso America, for EPA Registration Number 8033-22.
g Values are on a per year basis unless designated with /CC in which case a value on the number of specified applications per crop cycle is provided.

Appendix K. Estimated Environmental Concentrations for Acetamiprid Alone and with Different Drift Assumptions

EECs are shown for aerial applications, unless otherwise specified.

Table K1. Surface Water EECs for Parent Acetamiprid Alone (Estimated Using PWC version 1.52 and PFAM version 2.0)

Use	PWC Scenario	Application Scenario[2]	1-in-10 year EEC µg/L				
			Water Column			Pore-Water	
			1-day	21-day	60-day	Peak[1]	21-day
Cotton	CAcotton_wirrigSTD	0.15 (0.17), 2x, 0.1 (0.11), 1x, 7 d	3.09	2.81	2.45	1.72	1.71
	MScottonSTD		9.03	8.37	6.78	4.48	4.53
	NCcottonSTD		10.3	9.83	8.93	7.01	7.01
Pome Fruit	NCappleSTD	0.15 (0.17), 4x, 12 d	9.25	8.54	7.61	5.66	5.64
	ORappleSTD		5.48	5.06	4.58	3.7	3.69
	PAappleSTD_v2STD		9.77	9.29	8.47	6.15	6.13
	CaFruit_wirrigSTD		5.02	4.66	4.15	3	2.99
Citrus	CAcitrus_WirrigSTD	0.25 (0.28), 2x, 7d, 0.05 (0.06), 1x	4.62	4.34	3.92	2.77	2.76
	FLcitrusSTD		12.9	11.6	9.32	6.09	6.26
	FLcitrusSTD	0.11 (0.12), 5x, 7 d	10.9	10	8.61	5.93	6.02
Tree Nuts	CAalmond_WirrigSTD	0.18 (0.20), 4x, 0.72, 14 d	6.27	5.93	5.43	4.37	4.36
	ORfilbertSTD		6.24	5.77	5.29	4.36	4.35
	GApecanSTD		11.0	10.1	8.71	6.17	6.15
Fruiting Vegetables	FLcucumberSTD	0.15 (0.17), 1x,0.075 (0.084) 4x, 7 d	11.4	10.6	9.17	5.97	5.9
Leafy Vegetables	CALettuceSTD		6.95	6.66	6.17	4.74	4.74
	FLcabbageSTD		5.90	5.46	5.22	3.54	3.52
13-07-G Low Growing Berry Subgroup (including cranberries)	Flstrawberry_WirrigSTD	0.13 (0.15), 2x, 7 d in February, May, and August[3]	11.2	10.3	8.72	6.99	6.96
	ORberriesOP		5.61	5.36	5.02	4.56	4.56
	Flstrawberry_WirrigSTD	0.13 (0.15), 2x, 7 d4	4.85	4.62	4.21	2.91	2.9
Ornamentals	CAnurserySTD_V2	0.52 (0.58), 1x, 7d, 0.03 (0.033), 1x[5]	6.51	6.13	5.38	3.79	3.78
	FLnurserySTD_V2		15.6	14.1	11.2	6.88	6.86
	MInurserySTD_V2		7.1	6.64	6.1	4.63	4.62
	NJnurserySTD_V2		7.58	7.17	6.28	4.44	4.43
	ORnurserySTD_V2		5.87	5.58	5.03	3.65	3.64
	TNnurserySTD_V2		9.00	8.2	6.69	4.32	4.31
Cranberry	MA_Cranberry-Winter Flood STD.PFA	0.13 (0.15), 2x, 7 d	0.04	0.004	0.001	--	--
	OR_Cranberry-Winter Flood STD.PFA		0.07	0.049	0.040	--	--
	WI_Cranberry-Winter Flood STD.PFA		0.04	0.039	0.032	--	--

^ Pesticide mass is distributed in the soil linearly increasing with depth down to the depth specified by the user.
[1] The daily average benthic pore-water EEC is expected to be almost identical to the peak EEC.
[2] The application scenario is provided in lbs a.i./A (kg a.i./ha), number of applications, followed by the minimum retreatment interval in days (d). Results are shown assuming an aerial application scenario unless otherwise specified.
[3] Two applications were assumed to occur in February, May, and August to simulation multiple crop seasons per year.

[4] One simulation for berries with one crop cycle per year was simulated as multiple crop cycles per year is not expected to occur for all berries.
[5] In this scenario one application was simulated at 0.52 lb a.i./A and one application was simulated at 0.03 lbs a.i./A.

Table K2. Surface Water EECs for Parent Plus IM 1-4 Assuming a Medium to Coarse DSD (Estimated Using PWC version 1.52 and PFAM version 2.0)

Use	PWC Scenario	Application Scenario[2]	1-in-10 year EEC µg/L				
			Water Column			Pore-Water	
			1-day	21-day	60-day	Peak[1]	21-day
Cotton	CAcotton_wirrigSTD	0.15 (0.17), 2x, 0.1 (0.11), 1x, 7 d	4.46	4.31	4.09	3.4	3.39
	MScottonSTD		16	15.6	14.5	12.1	12.1
	NCcottonSTD		25.8	25.4	25	22.8	22.8
Pome Fruit	NCappleSTD	0.15 (0.17), 4x, 12 d	16.4	15.9	15.2	13.2	13.2
	ORappleSTD		12.1	11.9	11.6	10.8	10.8
	PAappleSTD_v2STD		21	20.5	19.5	18.9	19
	CaFruit_wirrigSTD		7.46	7.25	6.95	5.92	5.91
Citrus	CAcitrus_WirrigSTD	0.25 (0.28), 2x, 7d, 0.05 (0.06), 1x	6.31	6.17	5.94	5.09	5.09
	FLcitrusSTD		22.5	21.7	20.4	17.3	17.3
	FLcitrusSTD	0.11 (0.12), 5x, 7 d	23.4	22.9	21.6	17.6	17.6
Tree Nuts	CAalmond_WirrigSTD	0.18 (0.20), 4x, 0.72, 14 d	10.9	10.8	10.4	9.19	9.19
	ORfilbertSTD		14.1	13.8	13.4	12.5	12.5
	GApecanSTD		19.7	19.1	18.5	15.9	16
Fruiting Vegetables	FLcucumberSTD	0.15 (0.17), 1x,0.075 (0.084) 4x, 7 d	22.1	22.7	20.4	16.1	15.7
Leafy Vegetables	CALettuceSTD		16.2	16	15.6	13.8	13.8
	FLcabbageSTD		11.7	11.4	10.6	8.49	8.39
13-07-G Low Growing Berry Subgroup (including cranberries)	Flstrawberry_WirrigSTD	0.13 (0.15), 2x, 7 d in February, May, and August[3]	30.4	29.4	28.3	24.9	24.9
	ORberriesOP		14.8	14.5	14.2	13.6	13.6
	Flstrawberry_WirrigSTD	0.13 (0.15), 2x, 7 d[4]	9.9	9.65	9.14	7.31	7.3
Ornamentals	CAnurserySTD_V2	0.52 (0.58), 1x, 7d, 0.03 (0.033), 1x[5]	11.1	10.9	10.5	9.22	9.21
	FLnurserySTD_V2		26.6	25.7	24.1	19.1	19.1
	MInurserySTD_V2		17.3	17	16.7	14.9	14.9
	NJnurserySTD_V2		14.2	13.9	13.4	11.5	11.4
	ORnurserySTD_V2		11.2	11.1	10.8	9.57	9.56
	TNnurserySTD_V2		13.8	13.4	12.8	10.8	10.8

^ Pesticide mass is distributed in the soil linearly increasing with depth down to the depth specified by the user.
[1] The daily average benthic pore-water EEC is expected to be almost identical to the peak EEC.
[2] The application scenario is provided in lbs a.i./A (kg a.i./ha), number of applications, followed by the minimum retreatment interval in days (d). Results are shown assuming an aerial application scenario unless otherwise specified.
[3] Two applications were assumed to occur in February, May, and August to simulation multiple crop seasons per year.
[4] One simulation for berries with one crop cycle per year was simulated as multiple crop cycles per year is not expected to occur for all berries.
[5] In this scenario one application was simulated at 0.52 lb a.i./A and one application was simulated at 0.03 lbs a.i./A.

Table K3. Surface Water EECs for Parent Plus IM 1-4 Assuming a Fine to Medium /Coarse DSD for Ground Boom Applications(Estimated Using PWC version 1.52 and PFAM version 2.0)

Use	PWC Scenario	Application Scenario[2]	1-in-10 year EEC µg/L				
			Water Column			Pore-Water	
			1-day	21-day	60-day	Peak[1]	21-day
Cotton	CAcotton_wirrigSTD	0.15 (0.17), 2x,	1.19	1.16	1.11	0.965	0.964

Use	PWC Scenario	Application Scenario[2]	1-in-10 year EEC µg/L				
			Water Column			Pore-Water	
			1-day	21-day	60-day	Peak[1]	21-day
	MScottonSTD	0.1 (0.11), 1x, 7 d	13.6	13.2	12.3	10.2	10.2
	NCcottonSTD		23.3	22.9	23	20.8	20.8
Pome Fruit	NCappleSTD	0.15 (0.17), 4x, 12 d	13.1	12.7	12.1	10.5	10.5
	ORappleSTD		8.09	7.95	8.04	7.48	7.48
	PAappleSTD_v2STD		17.8	17.3	16.8	16.6	16.7
	CaFruit_wirrigSTD		4.42	4.3	4.13	3.5	3.5
Citrus	CAcitrus_WirrigSTD	0.25 (0.28), 2x, 7d, 0.05 (0.06), 1x	3.62	3.55	3.42	2.99	2.99
	FLcitrusSTD		21.1	20.3	19	16.2	16.2
	FLcitrusSTD	0.11 (0.12), 5x, 7 d	22.2	21.5	20.3	16.5	16.5
Tree Nuts	CAalmond_WirrigSTD	0.18 (0.20), 4x, 0.72, 14 d	6.88	6.78	6.6	5.84	5.84
	ORfilbertSTD		9.23	9.18	9.33	8.57	8.57
	GApecanSTD		17	16.4	16	14.1	14.2
Fruiting Vegetables	FLcucumberSTD	0.15 (0.17), 1x,0.075 (0.084) 4x, 7 d	20.4	21	18.5	14.6	14.1
Leafy Vegetables	CALettuceSTD		12.2	12	11.7	10.3	10.2
	FLcabbageSTD		9.42	9.1	8.17	6.62	6.28
13-07-G Low Growing Berry Subgroup (including cranberries)	Flstrawberry_WirrigSTD	0.13 (0.15), 2x, 7 d in February, May, and August[3]	27	26.1	25.1	22	22
	ORberriesOP		7.45	7.49	7.36	6.7	6.7
	Flstrawberry_WirrigSTD	0.13 (0.15), 2x, 7 d[4]	8.57	8.37	7.91	6.16	6.15
Ornamentals	CAnurserySTD_V2	0.52 (0.58), 1x, 7d, 0.03 (0.033), 1x[5]	6.95	6.78	6.56	5.9	5.9
	FLnurserySTD_V2		23.9	23.2	21.7	17.2	17.2
	MInurserySTD_V2		11.3	11.2	11	9.89	9.89
	NJnurserySTD_V2		9.05	8.76	8.4	7.14	7.13
	ORnurserySTD_V2		5.67	5.59	5.46	4.86	4.86
	TNnurserySTD_V2		9.42	9.03	8.64	7.55	7.6

^ Pesticide mass is distributed in the soil linearly increasing with depth down to the depth specified by the user.

1 The daily average benthic pore-water EEC is expected to be almost identical to the peak EEC.

2 The application scenario is provided in lbs a.i./A (kg a.i./ha), number of applications, followed by the minimum retreatment interval in days (d). Results are shown assuming an aerial application scenario unless otherwise specified.

3 Two applications were assumed to occur in February, May, and August to simulation multiple crop seasons per year.

4 One simulation for berries with one crop cycle per year was simulated as multiple crop cycles per year is not expected to occur for all berries.

5 In this scenario one application was simulated at 0.52 lb a.i./A and one application was simulated at 0.03 lbs a.i./A.

Appendix L. Acute and Chronic RQs (Mean Kenaga Values) for Terrestrial Animals Based on the Evaluated Uses of Acetamiprid (and Using a Foliar Dissipation Half-life of 35 Days)

The acute dose-based RQ values, based on toxicity to zebra finch, exceed the LOC for acute risk to listed (RQ≥0.1) and non-listed (RQ≥0.5) species for all size classes for short grass and arthropod food sources under all of the evaluated use scenarios except for low-growing berries with a single crop cycle (**Table J1**). Under the citrus, ornamental, pome fruit and tree nut use scenarios, there were additional LOC exceedances for acute risk to both listed and non-listed species for all bird size classes for the broadleaf plants/small insects food source. Sub-acute dietary-based RQ values, based again on toxicity to zebra finch, exceed the LOC for acute risk to listed (RQ≥0.1) and/or non-listed (RQ≥0.5) birds for short grass and arthropod food sources under the citrus, ornamental, pome fruit and tree nut use scenarios. There are no exceedances of the chronic risk LOC (RQ≥1) for any of the evaluated use scenarios when calculated using the measured mallard duck NOAEC. The chronic RQs likely underestimate the potential for risk for passerines, as chronic toxicity data are not available for passerines.

Table L1. Acute and Chronic RQs (Mean Kenaga Values) For Birds Based on the Evaluated Acetamiprid Uses and Using the 6.15 days Foliar Dissipation Half-life.

Food Type	Acute Dose-Based RQs[1] *Zebra finch (LD_{50} = 5.68 mg/kg bw)*			Subacute Dietary RQs[2] *Zebra finch (LC_{50} = 58.2 mg/kg diet)*	Chronic Dietary-Based RQs *Mallard duck[3]*
	Small (20 g)	Medium (100 g)	Large (1000 g)		
Citrus: 2x 0.249 lbs a.i./A, 1x 0.052 lbs a.i./A, 7-day interval					
Short grass	**7.46**	**3.34**	**1.06**	**0.68**	0.40
Tall grass	**3.16**	**1.41**	0.45*	0.29*	0.17
Broadleaf plants/small insects	**3.95**	**1.77**	**0.56**	0.36*	0.21
Fruits/pods/(seeds, dietary only)	**0.61**	0.28*	0.09	0.06	0.03
Arthropods	**5.70**	**2.55**	**0.81**	**0.52**	0.31
Seeds (granivore)	0.14*	0.06	0.02	NA	
Cotton: 4x 0.101 lbs a.i./A, 7-day interval					
Short grass	**5.32**	**2.38**	**0.76**	0.49*	0.29
Tall grass	**2.25**	**1.01**	0.32*	0.21*	0.12
Broadleaf plants/small insects	**2.82**	**1.26**	0.40*	0.26*	0.15
Fruits/pods/(seeds, dietary only)	0.44*	0.20*	0.06	0.04	0.02
Arthropods	**4.07**	**1.82**	**0.58**	0.37*	0.22
Seeds (granivore)	0.10*	0.04	0.01	NA	
Leafy & Fruiting Vegetables: 1x 0.15 lbs a.i./A, 3x 0.075 lbs a.i./A, 7 day interval					
Short grass	**4.74**	**2.12**	**0.67**	0.43*	0.25
Tall grass	**2.01**	**0.90**	0.29*	0.18*	0.11
Broadleaf plants/small insects	**2.51**	**1.12**	0.36*	0.23*	0.13
Fruits/pods/(seeds, dietary only)	0.39*	0.17*	0.06	0.04	0.02
Arthropods	**3.63**	**1.62**	**0.51**	0.33*	0.19
Seeds (granivore)	0.09	0.04	0.01	NA	
Low Growing Berries & Cranberries: 2x 0.131 lbs a.i./A, 7 day interval					
Short grass	**3.92**	**1.76**	**0.56**	0.36*	0.21
Tall grass	**1.66**	**0.74**	0.24*	0.15*	0.09
Broadleaf plants/small insects	**2.08**	**0.93**	0.29*	0.19*	0.11

Food Type	Acute Dose-Based RQs[1] *Zebra finch (LD50 = 5.68 mg/kg bw)* Small (20 g)	Medium (100 g)	Large (1000 g)	Subacute Dietary RQs[2] *Zebra finch (LC50 = 58.2 mg/kg diet)*	Chronic Dietary-Based RQs *Mallard duck[3]*
Fruits/pods/(seeds, dietary only)	0.32*	0.14*	0.05	0.03	0.02
Arthropods	**3.00**	**1.34**	0.43*	0.27*	0.16
Seeds (granivore)	0.07	0.03	0.01	NA	
Low Growing Berries (3 crop cycles): Per CC - 2x 0.132 lbs a.i./A, 1x 0.032 lbs a.i./A, 7 day interval					
Short grass	**4.81**	**2.16**	**0.68**	0.44*	0.26
Tall grass	**2.04**	**0.91**	**0.29**	0.19*	0.11
Broadleaf plants/small insects	**2.55**	**1.14**	0.36*	0.23*	0.14
Fruits/pods/(seeds, dietary only)	0.40*	0.18*	0.06	0.04	0.02
Arthropods	**3.68**	**1.65**	**0.52**	0.34*	0.20
Seeds (granivore)	0.09	0.04	0.01	NA	
Ornamentals: 1x 0.52 lbs a.i./A, 1x 0.03 lbs a.i./A, 7 day interval					
Short grass	**8.33**	**3.73**	**1.18**	**0.76**	0.45
Tall grass	**3.53**	**1.58**	**0.50**	0.32*	0.19
Broadleaf plants/small insects	**4.41**	**1.97**	**0.63**	0.40*	0.24
Fruits/pods/(seeds, dietary only)	**0.69**	0.31*	0.10*	0.06	0.04
Arthropods	**6.37**	**2.85**	**0.90**	**0.58**	0.34
Seeds (granivore)	0.15*	0.07	0.02	NA	
Pome Fruit: 4x 0.15 lbs a.i./A, 12 day interval					
Short grass	**6.97**	**3.12**	**0.99**	**0.64**	0.37
Tall grass	**2.95**	**1.32**	0.42*	0.27*	0.16
Broadleaf plants/small insects	**3.69**	**1.65**	**0.52**	0.34*	0.20
Fruits/pods/(seeds, dietary only)	**0.57**	0.26*	0.08	0.05	0.03
Arthropods	**5.33**	**2.39**	**0.76**	0.49*	0.29
Seeds (granivore)	0.13*	0.06	0.02	NA	
Tree Nuts: 4x 0.18 lbs a.i./A, 14 day interval					
Short grass	**7.98**	**3.57**	**1.13**	**0.73**	0.43
Tall grass	**3.38**	**1.51**	0.48*	0.31*	0.18
Broadleaf plants/small insects	**4.22**	**1.89**	**0.60**	0.39*	0.23
Fruits/pods/(seeds, dietary only)	**0.66**	0.29*	0.09	0.06	0.04
Arthropods	**6.10**	**2.73**	**0.87**	**0.56**	0.33
Seeds (granivore)	0.15*	0.07	0.02	NA	

NA=not applicable

Bolded values meet or exceed the LOCs for acute risk to both non-listed (RQ $\geq$ 0.5) and listed (RQ $\geq$ 0.1) bird species, or the LOC for chronic risk to bird species (RQ $\geq$ 1); values with an asterisk ("*") meet or exceed the LOC for acute risk to listed (RQ $\geq$ 0.1) bird species only.

[1] Acute dose-based RQ values are based on the zebra finch LD_{50} value of 5.68 mg a.i./kg-bw (MRID 48407701).

[2] Acute dietary RQ values are based on the zebra finch 5-day LC_{50} value of 58.2 mg a.i./kg diet (MRID 48844901).

[3] Chronic RQ values are based on the mallard duck NOAEC value of 99 mg a.i./kg diet (MRID 49342202).

The acute dose-based RQ values for small and/or medium-sized mammals exceed the LOC for acute risk to listed (RQ≥0.1) species foraging on short grass under the citrus, ornamental and tree nut use scenarios (**Table J2**). There are also acute risk LOC exceedances for small-sized listed species foraging on arthropods for the ornamental and tree nut use scenarios. There are no RQs exceeding the acute risk LOC for non-listed species (RQ≥0.5) under any use scenario; and, there are no dietary-based RQ exceedances of the chronic risk LOC (RQ≥1) under any use scenario.

Table L2. Acute and Chronic RQs (Mean Kenaga Values) For Mammals Based on the Evaluated Acetamiprid Uses and Using the 6.15 days Foliar Dissipation Half-life.

Food Type	Acute Dose-Based RQs[1]			Chronic Dietary-Based RQs
	Small (15 g)	Medium (35 g)	Large (1000 g)	
Citrus: 2x 0.249 lbs a.i./A, 1x 0.052 lbs a.i./A, 7-day interval				
Short grass	0.12*	0.10*	0.05	0.25
Tall grass	0.05	0.04	0.02	0.10
Broadleaf plants/small insects	0.06	0.05	0.03	0.13
Fruits/pods/(seeds, dietary only)	0.01	0.01	<0.01	0.02
Arthropods	0.09	0.08	0.04	0.19
Seeds (granivore)	<0.01	<0.01	<0.01	NA
Cotton: 4x 0.101 lbs a.i./A, 7-day interval				
Short grass	0.08	0.07	0.04	0.18
Tall grass	0.04	0.03	0.02	0.07
Broadleaf plants/small insects	0.04	0.04	0.02	0.09
Fruits/pods/(seeds, dietary only)	0.01	0.01	<0.01	0.01
Arthropods	0.06	0.05	0.03	0.13
Seeds (granivore)	<0.01	<0.01	<0.01	NA
Leafy & Fruiting Vegetables: 1x 0.15 lbs a.i./A, 3x 0.075 lbs a.i./A, 7 day interval				
Short grass	0.07	0.06	0.03	0.16
Tall grass	0.03	0.03	0.01	0.07
Broadleaf plants/small insects	0.04	0.03	0.02	0.08
Fruits/pods/(seeds, dietary only)	0.01	0.01	<0.01	0.01
Arthropods	0.06	0.05	0.03	0.12
Seeds (granivore)	<0.01	<0.01	<0.01	NA
Low Growing Berries & Cranberries: 2x 0.131 lbs a.i./A, 7 day interval				
Short grass	0.06	0.05	0.03	0.13
Tall grass	0.03	0.02	0.01	0.06
Broadleaf plants/small insects	0.03	0.03	0.02	0.07
Fruits/pods/(seeds, dietary only)	0.01	<0.01	<0.01	0.01
Arthropods	0.05	0.04	0.02	0.10
Seeds (granivore)	<0.01	<0.01	<0.01	NA
Low Growing Berries (3 crop cycles): Per CC - 2x 0.132 lbs a.i./A, 1x 0.032 lbs a.i./A, 7 day interval				
Short grass	0.08	0.06	0.03	0.16
Tall grass	0.03	0.03	0.01	0.07
Broadleaf plants/small insects	0.04	0.03	0.02	0.08
Fruits/pods/(seeds, dietary only)	0.01	0.01	<0.01	0.01

Food Type	Acute Dose-Based RQs[1] Small (15 g)	Medium (35 g)	Large (1000 g)	Chronic Dietary-Based RQs
Arthropods	0.06	0.05	0.03	0.12
Seeds (granivore)	<0.01	<0.01	<0.01	NA
Ornamentals: 1x 0.52 lbs a.i./A, 1x 0.03 lbs a.i./A, 7 day interval				
Short grass	0.13*	0.11*	0.06	0.28
Tall grass	0.06	0.05	0.03	0.12
Broadleaf plants/small insects	0.07	0.06	0.03	0.15
Fruits/pods/(seeds, dietary only)	0.01	0.01	<0.01	0.02
Arthropods	0.10*	0.09	.0.05	0.21
Seeds (granivore)	<0.01	<0.01	<0.01	NA
Pome Fruit: 4x 0.15 lbs a.i./A, 12 day interval				
Short grass	0.11*	0.09	0.05	0.23
Tall grass	0.05	0.04	0.02	0.10
Broadleaf plants/small insects	0.06	0.05	0.03	0.12
Fruits/pods/(seeds, dietary only)	0.01	0.01	<0.01	0.02
Arthropods	0.08	0.07	0.04	0.18
Seeds (granivore)	<0.01	<0.01	<0.01	NA
Tree Nuts: 4x 0.18 lbs a.i./A, 14 day interval				
Short grass	0.13*	0.11*	0.06	0.26
Tall grass	0.05	0.05	0.02	0.11
Broadleaf plants/small insects	0.07	0.06	0.03	0.14
Fruits/pods/(seeds, dietary only)	0.01	0.01	<0.01	0.02
Arthropods	0.10*	0.08	0.04	0.20
Seeds (granivore)	<0.01	<0.01	<0.01	NA

NA=not applicable
Values with an asterisk ("*") meet or exceed the LOC for acute risk to listed ($RQ \geq 0.1$) mammals only.
[1] Acute dose-based RQ values are based on the laboratory rat LD_{50} value of 146 mg a.i./kg-bw (MRID 44651833).
[2] Chronic RQ values are based on the two-generation laboratory rat NOAEC value of 160 mg a.i./kg diet (MRID 44988429).

Estimated environmental concentrations (EECs) calculated by T-REX in the analysis of acute and chronic risk to terrestrial animals based on mean Kenaga values and a 35-day foliar dissipation half-life are summarized in **Table L3.**

Table L3. T-REX calculated EECs (Mean Kenaga Values) as Food Residues for Terrestrial Animals Based on the Evaluated Acetamiprid Uses and Using the 6.15-day Foliar Dissipation Half-life.

Food Type	Dietary-Based EEC (mg/kg-diet)	Dose-Based EEC (mg/kg-body weight)					
		Birds			Mammals		
		Small (20 g)	Medium (100 g)	Large (1000 g)	Small (15 g)	Medium (35 g)	Large (1000 g)
Citrus: 2x 0.249 lbs a.i./A, 1x 0.052 a.i./A, 7-day interval							
Short grass	39.59	45.09	25.71	11.51	37.75	26.09	6.05
Tall grass	16.77	19.10	10.89	4.88	15.99	11.05	2.56
Broadleaf plants/small insects	20.96	23.87	13.61	6.09	19.98	13.81	3.20
Fruits/pods/(seeds, dietary only)	3.26	3.71	2.12	0.95	3.11	2.15	0.50
Arthropods	30.27	34.48	19.66	8.80	28.86	19.95	4.63
Seeds (granivore)	N/A	0.83	0.47	0.21	0.69	0.48	0.11
Cotton: 4x 0.101 lbs a.i./A, 7-day interval							
Short grass	28.23	32.15	18.33	8.21	26.91	18.60	4.31
Tall grass	11.96	13.62	7.76	3.48	11.40	7.88	1.83
Broadleaf plants/small insects	14.94	17.02	9.71	4.35	14.25	9.85	2.28
Fruits/pods/(seeds, dietary only)	2.32	2.65	1.51	0.68	2.22	1.53	0.36
Arthropods	21.59	24.59	14.02	6.28	20.58	14.22	3.30
Seeds (granivore)	N/A	0.59	0.34	0.15	0.49	0.34	0.08
Leafy & Fruiting Vegetables: 1x 0.15 lbs a.i./A, 3x 0.075 lbs a.i./A, 7-day interval							
Short grass	25.17	28.66	16.35	7.32	24.00	16.58	3.85
Tall grass	10.66	12.14	6.92	3.10	10.16	7.02	1.63
Broadleaf plants/small insects	13.32	15.17	8.65	3.87	12.70	8.78	2.04
Fruits/pods/(seeds, dietary only)	2.07	2.36	1.35	0.60	1.98	1.37	0.32
Arthropods	19.25	21.92	12.50	5.60	18.35	12.68	2.94
Seeds (granivore)	N/A	0.52	0.30	0.13	0.44	0.30	0.07
Low Growing Berries & Cranberries: 2x 0.131 lbs a.i./A, 7-day interval							
Short grass	20.83	23.72	13.53	6.06	19.86	13.72	3.18
Tall grass	8.82	10.05	5.73	2.57	8.41	5.81	1.35
Broadleaf plants/small insects	11.03	12.56	7.16	3.21	10.51	7.27	1.68
Fruits/pods/(seeds, dietary only)	1.72	1.95	1.11	0.50	1.64	1.13	0.26
Arthropods	15.93	18.14	10.34	4.6	15.19	10.50	2.43
Seeds (granivore)	N/A	0.43	0.25	0.11	0.36	0.25	0.06
Low Growing Berries (3 crop cycles)[1]: Per CC – 2x 0.132 lbs a.i./A, 1x 0.032 lbs a.i./A, 7-day interval							
Short grass	25.54	29.09	16.59	7.43	24.35	16.83	3.90
Tall grass	10.82	12.32	7.03	3.15	10.31	7.13	1.65
Broadleaf plants/small insects	13.52	15.40	8.78	3.93	12.89	8.91	2.07
Fruits/pods/(seeds, dietary only)	2.10	2.40	1.37	0.61	2.01	1.39	0.32

Food Type	Dietary-Based EEC (mg/kg-diet)	Dose-Based EEC (mg/kg-body weight)					
		Birds			Mammals		
		Small (20 g)	Medium (100 g)	Large (1000 g)	Small (15 g)	Medium (35 g)	Large (1000 g)
Arthropods	19.53	22.25	12.69	5.68	18.62	12.87	2.98
Seeds (granivore)	N/A	0.53	0.30	0.14	0.45	0.31	0.07
Ornamentals: 1x 0.52 lbs a.i./A, 1x 0.03 lbs a.i./A, 7-day interval							
Short grass	44.20	50.34	28.71	12.85	42.14	29.13	6.75
Tall grass	18.72	21.32	12.16	5.44	17.85	12.34	2.86
Broadleaf plants/small insects	23.40	26.65	15.20	6.80	22.31	15.42	3.58
Fruits/pods/(seeds, dietary only)	3.64	4.15	2.36	1.06	3.47	2.40	0.56
Arthropods	33.80	38.49	21.95	9.83	32.23	22.27	5.16
Seeds (granivore)	N/A	0.92	0.53	0.24	0.77	0.53	0.12
Pome Fruit: 4x 0.15 lbs a.i./A, 12-day interval							
Short grass	36.98	42.12	24.02	10.75	35.26	24.37	5.65
Tall grass	15.66	17.84	10.17	4.55	14.93	10.32	2.39
Broadleaf plants/small insects	19.58	22.30	12.71	5.69	18.67	12.90	2.99
Fruits/pods/(seeds, dietary only)	3.05	3.40	1.98	0.89	2.90	2.01	0.47
Arthropods	28.28	32.21	18.37	8.22	26.96	18.63	4.30
Seeds (granivore)	N/A	0.77	0.44	0.20	0.65	0.45	0.10
Tree Nuts: 4x 0.18 lbs a.i./A, 14-day interval							
Short grass	42.34	48.22	27.50	12.31	40.37	27.90	6.47
Tall grass	17.93	20.42	11.65	5.21	17.10	11.82	2.74
Broadleaf plants/small insects	22.42	25.53	14.56	6.52	21.37	14.77	3.42
Fruits/pods/(seeds, dietary only)	3.49	3.97	2.26	1.01	3.32	2.30	0.53
Arthropods	32.38	36.88	21.03	9.41	30.87	21.34	4.95
Seeds (granivore)	N/A	0.88	0.50	0.23	0.74	0.51	0.12

[1] Crop cycles were assumed to begin in February, May and August, based on planting information provided by BEAD.